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MISSOURI BOTANICAL GARDEN BULLETIN

VOLUME XXX

WITH 52 PLATES AND
26 TEXT-FIGURES

1942

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SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date until his death in 1889 it was maintained under his personal direction. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was chosen by Mr. Shaw and he definitely indicated that he wished it called by that name. The Garden passed at his death into the hands of a Board of Trustees, designated in Mr. Shaw's will, and the Board so constituted, exclusive of certain ex-officio members, is self perpetuating. By a further provision of the will the immediate direction of the Garden is vested in a Director, appointed by the Board. The Garden receives no support from city or state but is maintained almost exclusively from the estate left by Henry Shaw. Since 1939 many Garden Clubs and interested individuals have contributed to a "Friends of the Garden Fund" which is used in developing the new Arboretum, located at Gray Summit, Mo. The Arboretum (1) serves as a source of plants, trees and shrubs for the city Garden; (2) affords areas for gradually establishing a pinetum, a wild-flower reservation and various other features on a scale not possible in the city; (3) provides greenhouses for some 20,000 orchid plants.

The city Garden comprises 75 acres, where about 12,000 species of plants are grown, both out of doors and under glass. It is open every day in the year except New Year's Day and Christmas; week days, 8:00 a. m. until sunset; Sundays, 10:00 a. m. until sunset. The greenhouses are closed every day at 5:00 p. m.

The main entrance to the Garden is at Tower Grove Avenue and Flora Place, on the Sarah car line (No. 42). The Tower Grove bus (No. 21), direct from downtown, passes within three blocks of the main entrance.

NEW TRAIL HOUSE AT THE ARBORETUM

Missouri Botanical Garden Bulletin

Vol. XXX JANUARY, 1942 No. 1

FIFTY-THIRD ANNUAL REPORT OF THE DIRECTOR

To the Board of Trustees:

The Director of the Garden has the honor to submit his report for the year ending December 31, 1941.

Thanks to the support of the "Friends of the Garden", it has been possible to continue the development of the Arboretum along necessary lines, details of which are given later. A total of $6,195.83 was received during the year from 375 individuals and 22 Garden Clubs. The Garden Club of St. Louis continues to be by far the largest contributing club, the proceeds of its "Garden Visiting Days" in 1941 amounting to $2,288.53.

Perhaps the largest and most important single improvement at the Arboretum this year is the Trail House. This building is located near the parking lot at a point from which the wild-flower trails begin and end. A major portion is to be used as a shelter, with the west 25 feet divided into a manager's office and rest-rooms. A room on the second floor is designed as an herbarium to contain specimens of the Arboretum flora, including horticultural varieties. A cellar under the office is well adapted for the storage of nursery stock and seed. The building itself is unique. The roof of nearly 6,000 square feet is covered with hand-split "shakes", and the supporting timbers, clearly visible in the pavilion portion, are Douglas Fir piles 15 inches in diameter up to 65 feet in length. The roof is supported on masonry piers, the same kind of stone being used to form three sides of the west wing. Knotty pine and pecky cypress are used for the interior finish. The north and northwest sides of the building appear to be ideal locations for growing yews and some 54 specimens are planted here.

Considerable progress was made during the summer on the new quarry road and a portion of the surface gravel was spread in December. This road is designed to join the west valley trail and thus become an outer circle drive adding 1½ miles to the road system. The area traversed will be different from that of any existing road. In less than a mile the quarry road section will give a comprehensive cross-section of the Missouri Ozarks.

While in the past the development of wild-flower displays has been the major problem, this year, for the first time, the effort has been to make the wild flowers available to the visitor. Two trails have been laid out, roughly, in the form of two concentric circles, both of which begin and end at the parking field. The shorter one runs along the side of the hill and can be traversed readily in fifteen minutes. The longer one goes down almost to the flood-plain, climbing back by easy stages, and requires nearly an hour.

In so far as possible, the trails have been constructed with materials native to the actual site. River gravel has been used only as a last resort since previous experience on the fire trails has shown that unsightly weeds tend to come in with the gravel and that it does not carry enough clay and sand to pack into a pleasant footpath. By digging down to the rock wherever it was near the surface, a practical all-weather trail was produced along the hillside which at its best looks like a natural rock garden and on which attractive native plants are already spreading among cracks in the rock. Where the site did not permit this treatment, steps were formed of cedar logs and filled in with gravel from the near-by creeks. This gravel packed down readily, carried no weed seeds and formed no new niches in which weeds could find a foothold. As time permitted, labelling trees and wild flowers along these trails has been continued. Old cedar stumps were utilized as far as possible, the letters being cut in with a mechanical router.

The chief consideration in the development of the wild-flower gardens has been to understand and encourage the flowers which are already native to the area rather than to bring in species from a distance. After a number of preliminary trials, a considerable number of species which are native to Franklin County but which for one reason or another are rare or lacking in the Arboretum were set out this summer near the trails and along the rail fence which borders the auto road. Since previous small-scale studies gave a fair understanding of the likes and dislikes of these species, it was possible to select places where they are naturally suited and they already appear very much at home. Among the species moved in are the common blue flag *(Iris virginica)*, the celandine poppy *(Stylophorum diphyllum)*, the marsh-mallow *(Hibiscus militaris)*, lavender balm *(Monarda fistulosa)*, virgin's bower *(Clematis virginiana)*, and the native dwarf iris *(Iris cristata)* of southern Missouri.

Ever since the Arboretum was first acquired various narcissi have been planted from time to time, and about ten years ago large-scale plantings of a few varieties were begun in the pinetum area. These introductions have been almost uniformly successful, partly because the basic soil type of the Arboretum is a sandy loam well suited to bulb culture. For the last four

years the plantings have been slowly enlarged (mainly by exchange) and very carefully studied. Not all varieties of narcissi do well when naturalized in the grass of meadows and open woodlands, nor is there any correlation between the price of the bulb and its desirability for this purpose. Some very old and cheap varieties (such as *Narcissus biflorus*) of most old southern gardens are excellent, and some of the newest and most conspicuous (and also most expensive) ones likewise have the rugged constitution necessary to withstand competition with blue-grass turf. This summer those varieties, of which there was sufficient material to make a mass display, were moved into the natural amphitheatre adjacent to the collection of oriental crabapples. Some 30 other varieties, purchased in quantities from dozens to bushels, were set out in the same area. Since nearly all of these have proved reliable in previous trials on a much smaller scale they should make an unusually effective display, particularly in two or three years after they have had time to become thoroughly established and to begin their natural increase. Eventually they will provide continuous mass effect from the time of the yellow trumpet daffodils in early March until the last of the "Poets Narcissi" some two months later. For the visitor who drives through the Arboretum during that time there will be narcissi literally by the millions, whole meadows of a few varieties in the pinetum and smaller masses of 50 to 100 of very carefully chosen varieties near the crabapple collection and at intervals along the rail fence.

The remnants of the oriental cherry orchard, established in 1925, were removed in September. Even without the disastrous effect of the November 1940 freeze, fifteen years seems to be about the life expectancy of the varieties tested in this region. A single tree very favorably placed may reach a greater age, but in an extensive plantation signs of deterioration will appear after twelve to fifteen years regardless of supplementary feeding and irrigation. On the contrary, the oriental crabapples appear to have improved each year. About 2,000 trees, comprising many new hybrids and varieties, are being grown with the intention of adding better kinds from time to time. These crabapples are in flower for two weeks beginning about April 20, and eventually they should provide one of the most attractive spring displays at the Arboretum.

Since the fire hazard is high, much attention has been given to protecting certain areas. It is generally recognized that early detection is the most important step in fire control. A small crew can put out a fire if it is reached in time, whereas later control may not be possible regardless of how many men are available. To expedite the prompt reporting of a fire, a new telephone circuit with six telephones has been installed at strategic points. All but a short stretch of this system is carried by underground cable. A

siren with a dependable range of at least two and one-half miles has been placed near the Trail House. This can be started and stopped automatically from any telephone, thus serving to report a fire as well as assemble the necessary man-power.

Mention was made in the last report of a proposed boxwood garden. Seven varieties are now established in what will be the permanent location, and with additions made from time to time every kind of box hardy in this locality should eventually be found here. Previous to planting, the area was plowed twice and tilled four times, with a crop of soy beans turned under as green manure.

The azalea garden, partly prepared last fall, was again tilled in the spring and about 500 plants set out. Ultimately this plantation will contain thousands rather than hundreds of azaleas. During the year 173 loads of sawdust were hauled from nearby mills and used as a mulch for boxwoods, azaleas, and groups of trees. Sawdust appears to have possibilities not only as a mulch but as a soil improver. In addition, if used deep enough it eliminates supplementary irrigation, and, being virtually fire-proof, it reduces that hazard in such groups as those found in the pinetum.

Mowing the open fields of blue grass required 430 hours of tractor operation. In certain fields, such as the pinetum and the crabapple orchard, every effort is made to stimulate the growth of this valuable grass. Consequently, mowing cannot begin until the blue grass seed has ripened, usually not before the first week of July. This explains the somewhat unkempt appearance of the Arboretum in June. As soon as the seed is ripe, it is harvested, dried, cleaned and stored for use in the fall. During the past year some 1,053 pounds of clean blue grass seed was obtained.

Portions of the rail fence were relocated and short stretches of new rails added. The possibility of naturalizing plants and vines along this type of fence was an important consideration when it was selected. It will require many years to develop the fence row to a point where it will appear a natural part of the landscape, but suitable plants of the native flora, together with those now being grown in the nursery, will eventually produce the interesting effect desired.

An infestation of bag-worms in the pinetum required 1,500 gallons of arsenical spray. The present indications are that the pest is under complete control.

The foregoing paragraphs indicate only the more important activities at the Arboretum and ignore such items as nearly 800 man-hours used to sod and finish grade the area about the Trail House, or 450 man-hours required to wreck and store the usable portions of two old buildings at unsightly locations. Over 1,500 man-hours were employed in cutting brush, which

is a routine activity almost every month of the year. Brush may be cut for many reasons: for road right-of-way, to make room for new plantings, to renew old fence rows, or to clear a space for some construction project. A tractor equipped with a bull-grader was operated 650 hours and used 775 gallons of gasoline and 134 quarts of oil. A second tractor, used for many purposes in addition to mowing, was operated 650 hours, consuming approximately the same amount of gasoline and 53 quarts of oil. In a normal year the 150,000-gallon reservoir at the greenhouses is filled from rain-water collected on the greenhouse roofs, but due to the very dry winter and spring it was empty in March and had to be filled three times with water pumped from the pinetum lake. Less than 100,000 gallons of water were withdrawn from the new reservoir near the parking lot, so that it was not necessary to refill it this fall.

Mr. August P. Beilmann, formerly Arboriculturist to the city Garden, has succeeded the late Mr. Lars P. Jensen as Manager of the Arboretum.

SUNSHINE RECORD

Month	*City Garden* Hours	*Arboretum* Hours
January	85.25	102.50
February	116.50	125
March	152.75	176
April	170.75	193
May	293	288
June	254.50	255.25
July	291.25	290
August	267.25	237.50
September	217.25	192
October	122	117
November	132	146
December	94.75	109
	2,197.25	2,231.25
		2,197.25
Excess of sunshine hours at Arboretum		34.00

CITY GARDEN CONSTRUCTION AND MAINTENANCE

The heating plant is naturally of fundamental importance and must at all times be kept in as perfect condition as possible. It has been estimated that with a greenhouse temperature of 75° and an outdoor temperature of zero, if the heat should be cut off, the houses would fall to freezing in about three hours. Thus, a complete failure of the heating plant in zero weather means that the contents of the greenhouses are only about three hours from total loss. Since the operation of the newly installed stokers is dependent

upon electricity, a gasoline-operated electric generator to be used in emergency has been installed. To remove fly ash from the boiler tubes the purchase of a single-stage air compressor was found necessary. One of the boilers at the Arboretum plant was retubed.

The main water-supply line from Shaw Avenue to the Linnean House was replaced with 250 feet of 2-inch pipe, and the usual amount of repairs made, including repairing thermostats, steam traps, expansion joints, etc. The heating system has been in operation for thirty years and consequently demands constant supervision to anticipate any weaknesses which may develop.

Two greenhouses were practically rebuilt. The entire roof structure was replaced with new sash bars and ventilators, galvanized iron being supplied wherever necessary. The interior and exterior of both houses were given two coats of aluminum paint. Additional painting comprised that of the interior of the pit houses, exterior of the exotic growing houses, and the iron fence bounding the Garden on Shaw, Alfred, Magnolia and Tower Grove Avenues. The Linnean House, built during the lifetime of Henry Shaw, had the ornamental copper gutters replaced with new copper. Necessary repairs were made to the roof, and the entire north wall of this old house was tuckpointed.

MAIN CONSERVATORIES AND EXOTIC RANGES

To have a reasonable conception of the maintenance required in the public greenhouses, it is necessary to review briefly the work that is carried on during the year. Of course, the regular gardening operations, such as pruning, spraying, watering, cultivating, etc., are performed year after year on about the same scale. However, changes do occur at intervals, and it is these that demand attention, particularly when the houses are either partly or entirely revamped.

Since the original planting of trees in the Economic House, many of them have attained such proportions that their removal was necessary. Others were duplicates, and these were replaced by more attractive and interesting plants. Instead of allowing a small percentage of economic plants to remain on display, the rearranging of the whole house has made room for a larger collection.

One of the noteworthy trees to be cut down was a massive banyan *(Ficus benghalensis)* which adorned the center bed. It became impossible to grow anything under its canopy of dense foliage, and since it was also a rank feeder it deprived other plants of food and sunlight. Several other figs, among which was a 30-foot *Ficus elastica*, a 20-foot *F. utilis*, and a 15-foot *F. Benjamina*, were removed. Two 20-foot beautiful lace-leaved wild

tamarinds *(Pithecolobium filicifolium)*, two 20-foot bread-nuts *(Brosimum Alicastrum)*, two pigeon plums *(Coccoloba laurifolia)*, several single specimens of coffee *(Coffea arabica)*, Indian cherry *(Bunchosia biocellata)*, and honey-berry *(Melicocca bijuga)* made way for other more suitable material. All of the above plants are still represented in the collection and in addition more than 60 new varieties have been planted, the total number of economic plants having been increased to approximately 200 species.

In the Palm House additional ornamental plants were introduced, undesirable ones replaced, and old favorites pruned, trimmed and reset in suitable locations. A jungle effect has been obtained by attaching various showy bromeliads such as *Billbergia pyramidalis* and *Aechmea Weilbachii* to the palm trunks and planting a number of odd-shaped, deeply-lobed Philodendrons at the bases of tall, straight palms. The Panama-hat palm *(Carludovica palmata)* blossomed for the first time and bore picturesque red berries.

Many new plants were added in the Cactus House as a result of the First National Cactus Convention which was held at the Missouri Botanical Garden during the first week of July. The California Cactus Growers Association sponsored an exhibit of succulents in the Floral Display House which was well attended and proved highly educational. It featured colorful cactus bowls and dish gardens, unusual grafted cacti, outstanding crests or fasciations, rare seedlings and specimen plants. Mr. R. W. Kelly's bizarre collection of cactus crests, which proved such a great attraction, was donated to the Garden. Such novelties as *Espostoa lanata, Notocactus scopa, Cephalocereus polygonus, Trichocereus candicans, Cleistocactus Straussii, Mammillaria fragilis, M. Wildii, Echinocereus stoloniferus* and *E. Reichenbachii* were included among the rare grafted crests. A goodly portion of the California Cactus Growers' desert-plant display was likewise presented to the Garden.

The recently discovered Mexican cactus oddity, *Neogomesia agavioides*, was exhibited for the first time at the convention and later presented to the Garden. There are only four plants known to exist in the United States, the other three being in the possession of Mr. William Taylor Marshall, President of the Cactus and Succulent Society of America. The June issue of the BULLETIN was devoted wholly to the history of the Garden's succulent collection, and a copy was presented to each member attending the convention.

The roof in both the Bromeliad and Plant Curiosity Houses had to be replaced, and this necessitated the removal of all plants in these houses during the construction period. The job of replanting and resetting was completed just as the first cold wave struck St. Louis. Many new varieties

of ornamental flowering plants were added, some of the showiest being *Allamanda cathartica* var. *Hendersoni*, *Beloperone guttata*, *Plumbago rosea coccinea* and *Dichorisandra thyrsiflora*.

The problem of providing plants with suitable labels has apparently been solved. About five years ago, a few tags were made of green celluloid, lettered with India ink, and varnished for permanency. These proved so satisfactory that a change to these more serviceable labels is gradually being made. Over a thousand old tags have already been replaced.

The aquatic display of Nymphaeas is a major item on the summer schedule at the Garden, and the propagation of these plants is carried on throughout the year. During 1941 between 400 and 500 plants were propagated in the greenhouse tanks. Of this number, about 200 were planted outdoors in the three main pools to form the chief summer display. An additional 200 potted specimens were placed in the remaining pools to test their color value, ease of propagation, etc. All of these were from the crosses of the preceding year.

In the past twenty-five years, the Missouri Botanical Garden has developed a number of outstanding tropical day-blooming water-lilies. Since the introduction of the yellow "St. Louis" in 1930, approximately 544 cross-pollinations have been made, resulting in a number of worthwhile hybrids, which were discussed and illustrated in color in the March 1941 BULLETIN. An outstanding achievement of the year was the introduction of the colorful "Talisman", the closest approach to an orange flower in the Nymphaeas. Another novelty was the double-flowered "Midnight", an absolutely new break in tropical lilies.

The breeding of tropical water-lilies remains in the care of Mr. George H. Pring, Superintendent to the Garden, where it has been for the past twenty-five years.

Mr. Ladislaus Cutak is responsible for the exotic collections in the main display greenhouse.

OUTDOOR GARDENS

When analyzing the gardens at the end of this year we find that, with the exception of slight variations, they were affected by the weather in much the same way as in the past ten years. A drought occurs each year, and may be expected any time between May and November. The summer of 1941 was no exception, and although it was followed by one of the wettest fall seasons on record there still was an accumulated rainfall deficiency of 5.32 inches at the end of the year.

The two perennial beds bordering the flagstone walk just west of the Linnean garden were entirely replanted in October. The trees and shrubs

in this area cast so much shade that it was deemed advisable to use only spring-blooming material. This garden was planted with 30 varieties of narcissi, supplemented with bulbs of Chionodoxa, Leucojum, Muscari and Scilla. In addition, such perennials as Aquilegia, Alyssum, Anchusa, Dicentra, Iberis, Mertensia, Primula and Phlox were also used. During November several beds in the rose garden were replanted with new varieties of roses which had been on trial in the nursery. In the knoll beds 150 Hemerocallis, representing 10 varieties, were planted. These are dependable perennials which bloom in June following the display of iris and peonies.

EXPERIMENTAL GREENHOUSES

Many of the newer annuals and perennials were started in the experimental greenhouses and transplanted to the nursery to determine their value as ornamentals in this climate. Only a small percentage proved to be real improvements over existing varieties.

Plant propagation has been chiefly concerned with growing:

1. Over 10,000 seedlings of Azalea "Mollis Hybrids" for group plantings at the Arboretum.
2. Some 5,000 cuttings of Baltic ivy, most of which were planted as a ground cover in the Mausoleum.
3. Numerous cuttings of American holly selected from berry-producing (pistillate) trees.
4. Three hundred cuttings of a variety of the English holly from the State of Washington, now in the process of rooting in the greenhouse. If this holly proves to be hardy in St. Louis, it will be vastly superior to the American type *(Ilex opaca)* in ornamental value.
5. Many kinds of house- and garden-plants propagated by cuttings taken last fall, for use in the amateur gardening course which begins the first week in February.

The seedling and research work on orchids has progressed considerably. Several thousand hybrid seedlings in various stages of development are now on hand and the hybridization of outstanding varieties continues. Experiments started last year on the effect of light, nutrient solutions, increase of carbon dioxide, etc. have yielded some very interesting results which will be reported later.

A record attendance of 117 students in the amateur gardening course made it necessary to use nearly all the experimental greenhouse range for class work during February, March, April and May. Over 10,000 cuttings and 10,000 seedlings of annual and perennial plants were raised by members of the class in the greenhouses. In addition, several hundred pots of bulbs were forced into flower. This course continues to be given by Dr. D. C. Fairburn, Horticulturist to the Garden, who is in charge of much of the experimental work in horticulture.

GARDEN EXHIBIT (AZALEAS) AT THE ST. LOUIS FLOWER AND GARDEN SHOW

INDOOR FLORAL DISPLAYS

The orchid show opened January 26 and continued until March 9. At the Greater St. Louis Flower and Garden Show at the Arena, March 23 to 30, the Garden exhibited an azalea terrace garden. In late March azaleas and cinerarias were displayed in the Conservatory. These plants were gradually replaced with other spring flowers. Many pot plants were sent to the Christ Church Cathedral for the annual flower sermon on April 27. All plants were removed from the Floral Display House to provide space for the St. Louis Horticultural Society's spring show which was held May 24 and 25. The show of fancy-leaved caladiums and fuchsias was installed on May 29 and remained on display throughout the summer. The dahlia show was held September 27 and 28. The Veiled Prophet Queen's bouquet was displayed on October 9. The chrysanthemum show opened on November 9 with a Chinese setting, and differed from the two previous shows in that evergreens, garden houses and moon gates furnished the background. The chrysanthemums were followed by the display of poinsettias.

In addition to the regular orchid show, held early in the year, the orchid alcoves have been filled with an almost continuous display of these flowers. Some idea of the quantity of blooming plants produced at the Arboretum greenhouses and in town may be obtained from the following figures: species of Cattleya and Laelia, hybrids of Cattleya, Laeliocattleya, Brassocattleya, Brassolaeliocattleya, and Sophrocattleya, 13,688 flowers; Cypripediums, 2,156 flowers; Dendrobium, Oncidium, Vanda, Aerides, Phalaenopsis, and various botanical species produced 4,094 spikes or sprays of flowers. In addition, some 200 flowers from miscellaneous species were exhibited.

Mr. Paul Kohl, Floriculturist to the Garden, who arranges all of the shows held in the Floral Display House, is responsible for growing much of the material used in these displays as well as in most of the outdoor gardens.

SUPERVISED INSTRUCTION FOR SCHOOL-CHILDREN

More than 10,000 school-children and adults have participated in the nature study activities conducted by Miss Clara M. Heising, the special nature study teacher provided through the cooperation of the Board of Education. In addition to classes from the St. Louis schools, groups from St. Louis County and from Illinois have been conducted through the Garden as time permitted. Girl Scout and Brownie leaders with groups of Girl Scouts came for lessons in nature study and field trips, and many students and teachers were regular attendants at the early-morning bird walks held last spring and this fall. As an experiment, two teachers brought their "problem classes", about 90 pupils in all. As was emphasized last year by

the special report from the Speyer School of New York City, this type of instruction aroused keen interest in these children and its importance for certain groups is becoming recognized as never before.

During the Missouri State Teachers' Convention, groups of visiting teachers were conducted through the Garden, and as a result plans are being made to bring out-of-town classes to the Garden next year.

RESEARCH AND INSTRUCTION

Dr. J. M. Greenman, Curator of the Herbarium and Professor in the Henry Shaw School of Botany of Washington University, has devoted the greater part of his time and energies to the regular routine curatorial duties of the herbarium. He has continued to direct the work of graduate students majoring in taxonomy; and he has also given advanced courses in the morphology and taxonomy of higher plants in the Shaw School of Botany of Washington University. The number of students enrolled in these courses has continued about the same as in previous years.

Dr. Greenman, in the limited time available, has continued to pursue research work on various groups of flowering plants and to advance monographic and floristic studies on which he has long been engaged.

Dr. C. W. Dodge, Mycologist to the Garden and Professor in the Henry Shaw School of Botany of Washington University, has been on leave of absence during the year, serving as exchange professor at the National School of Agriculture, Guatemala. Besides carrying on the instructional work in the National School, Dr. Dodge has been able to devote part of his time to mycological investigations at the hospital as well as field trips to collect lichens and fungi. Dr. Grant D. Darker has given the instructoral work in mycology at Washington University during the absence of Dr. Dodge.

Dr. Edgar Anderson, Geneticist to the Garden and Engelmann Professor in the Henry Shaw School of Botany of Washington University, was on leave of absence during March at Columbia University in New York City where, in conjunction with Dr. Ernst Mayr of the American Museum of Natural History, he gave the Jesup Lectures for 1941. He was also in the East during July and August as a guest of the Carnegie Institution for Experimental Evolution at Cold Spring Harbor, Long Island.

Special grants from the American Philosophical Society have made it possible for Dr. Anderson to continue his studies of maize and its near relatives. One phase of this program was brought to completion with the publication by Dr. Hugh Cutler and Dr. Anderson of their "Preliminary Survey of the Genus Tripsacum," a curious group of grasses very closely related to corn.

Dr. Cutler's collections of maize from Central America have made it possible to extend this general survey to maize itself. In more than one way this is a peculiarly appropriate project for the Missouri Botanical Garden. The last previous survey was made somewhat over fifty years ago by Dr. E. Lewis Sturtevant, who bequeathed his herbarium and his extensive collection of original drawings of maize varieties to the Garden. In the intervening years, though maize has been studied in various ways, very little attention has been paid to the extension and revision of its classification. Dr. Anderson is therefore taking up the problem at essentially the point where Dr. Sturtevant laid it down. His first endeavor has been to build up as complete an herbarium record as possible of the various types of maize. Plantings were made last spring in triplicate, at the Missouri Botanical Garden, at Texas Agricultural and Mechanical College, with the collaboration of Dr. R. G. Reeves, and in Cuba at the Atkins Institution of the Arnold Arboretum of Harvard University, in collaboration with Dr. Paul C. Mangelsdorf. In addition to Dr. Cutler's Central American corn, extensive collections from the Southwest and from parts of Mexico have been received through the interest of Prof. Carl Sauer and Prof. Ralph Beals of the University of California. As a result there has already been assembled and is now being analyzed a representative sample of varieties of corn from North and Central America in which herbarium specimens of tassels and leaves are associated with the ears from which they were grown and notes taken as to their height, time of maturity, etc. While Dr. Sturtevant's older classification (into dent corns, flour corns, pop corns, etc.) is still adequate as a cataloguing device, this new collection is making it possible to work out a rough grouping indicating general relationships in somewhat the same way that anthropologists divide mankind into races and sub-races.

Dr. Robert E. Woodson, Jr., Assistant Curator of the Herbarium and Assistant Professor in the Henry Shaw School of Botany of Washington University, as in previous years, has devoted most of his time to three distinct activities: preparation of a *Flora of Panama* in collaboration with Mr. Robert W. Schery, Assistant in the Henry Shaw School of Botany of Washington University, taxonomic research in the Apocynaceae and Asclepiadaceae of tropical America, and the teaching of classes in botany at the University.

Work on the *Flora of Panama* has progressed to the assembly of manuscript on the monocotyledonous families. In addition to the accounts of miscellaneous groups being prepared by Dr. Woodson and Mr. Schery, generous collaboration is being received from numerous specialists in this country and Europe, including L. H. Bailey (Palmae), W. H. Camp (Lemnaceae), F. P. Jonker (Burmanniaceae), E. P. Killip (Amaryllidaceae),

C. V. Morton (Smilacaceae, Dioscoreaceae), H. N. Moldenke (Eriocaulaceae), L. B. Smith (Bromeliaceae), P. C. Standley (Araceae), H. K. Svenson (Cyperaceae), J. R. Swallen (Gramineae), and L. O. Williams (Orchidaceae). It is expected that this portion of the *Flora* will be ready for publication toward the close of 1942. With the aid of their numerous collaborators, Dr. Woodson and Mr. Schery have completed the determination of several extensive collections of Panamanian plants which have been made available for distribution to other institutions through the Curator of the Herbarium. The record of this aspect of the *Flora* during 1941 has appeared in a recent number of the ANNALS OF THE MISSOURI BOTANICAL GARDEN.

The taxonomic research of Dr. Woodson on the tropical American Apocynaceae and Asclepiadaceae has led to the recent publication of a drastic reorganization of the North American genera of the latter family, which has been urgent for many years. He also has assisted with identification of specimens and preparation of manuscript in his specialties for floristic projects of other botanical institutions.

At Washington University, Dr. Woodson has conducted his usual classes in General Plant Biology and Elementary Morphology and Taxonomy, with the assistance of Dr. Henry N. Andrews, Instructor, and Miss Eloise Pannell and Mr. Robert W. Schery, Assistants in the Henry Shaw School of Botany.

Graduates and Fellows.—The following appointments were made in the Henry Shaw School of Botany for the year 1941-1942:

Assistants in Botany: Eloise Pannell, B.Ed., Southern Illinois State Normal University, Carbondale (Morphology); Robert W. Schery, A.B. and M.S., Washington University (Taxonomy and Morphology).

Washington University Fellowships: Ralph O. Erickson, B.A., Gustavus Adolphus College, St. Peter, Minn., M.S., Washington University (Cytogenetics and Taxonomy); Gerald Bruce Ownbey, B.A. and M.A., University of Wyoming (Taxonomy); Howard C. Reynolds, A.B., University of Nebraska (Taxonomy).

Independent Students: Rev. Robert R. Brinker, O. F. M., A. B., St. Joseph's College, Westmont, Ill., Graduate of Theology, St. Joseph's Seminary (Taxonomy); Ralph W. Emons, A.B. and M.S., Washington University (Taxonomy); L. Wayne Lenz, A.B., University of Montana, M.S., Louisiana State University (Taxonomy).

Graduate Apprentice: Frederick G. Meyer, A.B. and M.S., State College of Washington (Taxonomy).

Degrees.—The following students in the Henry Shaw School of Botany received advanced degrees at the Washington University commencement in

June: Doctor of Philosophy—Edward C. Berry, B.S. in Ed., State Teachers College, Warrensburg, Mo., M.A., University of Missouri (Mycology); Master of Science—Stanley Bettoney, B. S., Massachusetts State College (Genetics); Louis G. Brenner, B.A., Washington University (Morphology); Ralph W. Emons, A.B., Washington University (Taxonomy); Ralph O. Erickson, B.A., Gustavus Adolphus College, St. Peter, Minn. (Taxonomy and Cytology).

Published Articles.—

Allen, Paul H.: How We Found the Rare Chinela Orchid. Garden Digest. March, 1941 (Reprinted from Garden BULLETIN).

Anderson, Edgar: Binary Variation in *Tradescantia bracteata.* Ann. Mo. Bot. Gard. April, 1941; Edward Murray East (1879-1938). Proc. Amer. Acad. Nov., 1940; The Fragrant Sumac. Garden Life. July, 1941; Review of Richard Goldschmidt's "The Material Basis of Evolution." Chron. Bot. Feb. 10, 1941; Review of Julian Huxley's "The New Systematics". Am. Midl. Nat. Jan., 1941; The Technique and Use of Mass Collections in Plant Taxonomy. Ann. Mo. Bot. Gard. Sept., 1941; with A. P. Beilmann and Robert B. Clark. Evergreens for St. Louis. Mo. Bot. Gard. Bull. Nov., 1941; with William L. Brown. *Poa cuspidata* of the Appalachian Plateau and Atlantic Costal Plain. Castanea. Dec., 1940; with Hugh C. Cutler. A Preliminary Survey of the Genus Tripsacum. Ann. Mo. Bot. Gard. Sept., 1941; and Ralph O. Erickson. Antithetical Dominance in North American Maize. Proc. Nat. Acad. Sci. Sept., 1941; with Leslie Hubricht. Vicinism in Tradescantia. Amer. Jour. Bot. Dec., 1941.

Andrews, H. N.: *Dichophyllum Moorei* and Certain Associated Seeds. Ann. Mo. Bot. Gard. Nov., 1941; On the Stelar Anatomy of the Pteridosperms with Particular Reference to the Secondary Wood. Chron. Bot. Dec. 30, 1940. (Abstracted from Ann. Mo. Bot. Gard.); and Cortland S. Pearsall: On the Flora of the Frontier Formation of Southwestern Wyoming. Ann. Mo. Bot. Gard. April, 1941.

Beilmann, August P.: An Attempt to Record Internal Tree Trunk Pressures. Shade Tree. Sept., 1941. (Reprinted from Garden ANNALS); Diagnoses of Tree Disorders. No. 2. Possible Use of Instruments. Trees. May-June, 1941; Don't Burn the Leaves. South. Flor. Jan., 1941. (Reprinted from Garden BULLETIN); Lightning and Trees. Flower Grower. Aug., 1941; and D. C. Fairburn. Azaleas for St. Louis and Vicinity. Mo. Bot. Gard. Bull. May, 1941; with Edgar Anderson and Robert B. Clark. Evergreens for St. Louis. Mo. Bot. Gard. Bull. Nov., 1941.

Berry, Edward C.: A Monograph of the Genus Parmelia in North America. Ann. Mo. Bot. Gard. Feb., 1941.

Brown, William L.: The Cytogenetics of *Poa pratensis*. Ann. Mo. Bot. Gard. Nov., 1941; and Edgar Anderson. *Poa cuspidata* of the Appalachian Plateau and Atlantic Costal Plain. Castanea. Dec., 1940; with G. T. Johnson. The Examination of Lichens by Smears Prepared in the Field. Bryologist. June, 1941; Stages in the Development of *Thelotrema interpositum*. Mycologia. Nov.-Dec., 1941.

Clark, Robert B.: with Edgar Anderson and A. P. Beilmann. Evergreens for St. Louis. Mo. Bot. Gard. Bull. Nov., 1941.

Cutak, Ladislaus: Cacti in the Outdoor Garden. Real Gardening. Feb., 1941; Cactus Gardening Indoors. Lawn and Garden Handbook No. 1. 1941; Culture of Succulents in the Midwest. Jour. Cactus & Succulent Soc. Amer. Jan., 1941; First National Convention of the Cactus & Succulent Society of America. Garden Life. June, 1941; A Flower Hunter in Florida. Desert Plant Life. Feb., 1941; "Foreword" to the Cactus Catalog Guide of the Irwin M. Krohn Conservatory. Cincinnati, Ohio. May, 1941; Haworthias are not Cacti. Garden Digest. Sept., 1941 (Reprinted from Garden BULLETIN); History of the Succulent Plant Collection at the Missouri Botanical Garden. Mo. Bot. Gard. Bull. June, 1941; Living Pebbles and Stones. Jour. Cactus & Succulent Soc. Amer. June, 1941. (Reprinted from Garden BULLETIN); The Missouri Botanical Garden. Jour. Cactus & Succulent Soc. Amer. May, 1941; The Much-abused Aspidistra Does Flower. Mo. Bot. Gard. Bull. Feb., 1941; Soapweed, Spanish Bayonet or Adam's Needle. Garden Gossip. April, 1941; Succulents Supreme. Real Gardening. Jan., 1941. (Reprinted from Garden BULLETIN); St. Louis Will Welcome You. Jour. Cactus & Succulent Soc. Amer. May, 1941; A Trip to the Land of Swaying Palms. Mo. Bot. Gard. Bull. Oct., 1941; A Word of Appreciation. (Relating to the First National Convention of Cactus Clubs). Jour. Cactus & Succulent Soc. Amer. Aug., 1941; Florida Adventure. Jour. Cactus & Succulent Soc. Amer. Dec., 1941.

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Dodge, Carroll W., Bertha S. Dodge and George Thomas Johnson: Some Effects of Carcinogens on Yeasts. Ann. Mo. Bot. Gard. Feb., 1941.

Erickson, Ralph O.: Mass Collections: *Camassia scilloides*. Ann. Mo. Bot. Gard. Sept., 1941; with Edgar Anderson. Antithetical Dominance in North American Maize. Proc. Nat. Acad. Sci. Sept., 1941; with Leslie Hubricht. Another Method for Recording Localities from Topographical Maps. Science. March, 21, 1941.

Fairburn, David C.: Azaleas for St. Louis and Vicinity. I. Propaga-

tion. Mo. Bot. Gard. Bull. May, 1941; Growing Plants. II. Vegetative Propagation. Mo. Bot. Gard. Bull. April, 1941; Mutiny. Garden Life. April, 1941; Raising Magnolias from Seed. Mo. Bot. Gard. Bull. Feb., 1941; and Paul A. Kohl: plates illustrating "Propagation of Plants". Gard. Chron. Amer. June, July, Aug., Sept., 1941. (From Garden BULLETIN).

Greenman, J. M.: Dr. George Engelmann and the Missouri Botanical Garden in Relation to Our Knowledge of Cacti. Jour. Cactus & Succulent Soc. Amer. Aug., 1941.

Hubricht, Leslie: Cave Mollusca of the Ozark Region. Nautilus. April, 1941; and Edgar Anderson. Vicinism in Tradescantia. Amer. Jour. Bot. Dec., 1941; and Ralph O. Erickson. Another Method for Recording Localities from Topographical Maps. Science. March 21, 1941; and Charles H. Harrison. The fresh water Amphipoda of Island County, Washington. Amer. Midl. Nat. Sept., 1941.

Jensen, L. P.: Fruit and Berry-bearing Trees and Shrubs. Garden Forum. Feb., 1941. (Reprinted from *Missouriana*).

Kohl, Paul A.: Gas Plant or Burning Bush. Nature Mag. Feb., 1941; Growing Plants. I. From Seed. Mo. Bot. Gard. Bull. April, 1941 (Reprinted in *Home Gardening*. Sept., 1941); Hedge Plants to Consider. Real Gardening. April, 1941. (Reprinted from Garden BULLETIN); and D. C. Fairburn. plates illustrating "Propagation of Plants". Gard. Chron. Amer. June, July, Aug., Sept., 1941. (From Garden BULLETIN).

Moore, George T.: Arboretum to be Opened for Garden Clubs. Garden Forum. April, 1941; Botanical Gardens Yesterday and Today. Mo. Bot. Gard. Bull. Oct., 1941.

Pring, George H.: Care and Feeding of Water-lilies. Real Gardening. March, 1941; How to Winter Tropical Water-lilies. Flower Grower. Oct., 1941. (Illustrations from Garden BULLETIN). Tropical Water-lilies. Mo. Bot. Gard. Bull. March, 1941. (Reprinted in *Southern Florist & Nurseryman*. April 10 and 17, 1941); The Veiled Prophet Queen's Bouquet, 1941. Amer. Orchid. Soc. Bull. Nov., 1941.

Schery, Robert W.: with Robert E. Woodson, Jr. Contributions toward a Flora of Panama. V. Collections chiefly by Paul H. Allen and by Robert E. Woodson, Jr. and Robert W. Schery. Ann. Mo. Bot. Gard. Nov., 1941.

von Schrenk, Hermann: with Henry Schmitz and Stanley I. Buckman. Studies of the Biological Environment in Treated Wood in Relation to Service Life. Proc. Amer. Wood Preservers' Assoc. 1941.

Woodson, Robert E., Jr.: Miscellaneous New Asclepiadaceae and Apocynaceae from Tropical America. Ann. Mo. Bot. Gard. Sept., 1941; The North American Asclepiadaceae. I. Perspective of the Genera. Ann. Mo. Bot. Gard. Nov., 1941; and Robert W. Schery. Contributions toward a

Flora of Panama. V. Collections chiefly by Paul H. Allen, and by Robert E. Woodson, Jr. and Robert W. Schery. Ann. Mo. Bot. Gard. Nov., 1941. with Bassett Maguire. Two New Asclepiads from the Southwestern United States. Ann. Mo. Bot. Gard. April, 1941.

Scientific and Popular Lectures.—

Dr. Edgar Anderson, Geneticist to the Garden: March 4, 6, 11, 13, 18, 20, 25, and 27, series of Jesup lectures at Columbia University, New York, "Systematics and the Origin of Species"; March 24, genetics seminar at Harvard University, "The Genetics of Species Crosses"; July 14, before the Long Island Biological Seminar, "Corn and Its Close Relatives"; July 24, Carnegie Institution Journal Club, Cold Spring Harbor, L. I., "The Genetic Analysis of a Species Cross".

Mr. A. P. Beilmann, Arboriculturist to the Garden: Feb. 22, before the Marguerite Krueger Conservation Club, "Conservation".

Mr. Stanley Bettoney, Graduate Student in the Shaw School of Botany: Feb., 26, St. Louis Academy of Science, "The Use of Colchicine in Plant Culture."

Mr. Ladislaus Cutak, in charge of Succulents at the Garden: March 26, elementary botany class, Washington University, and March 31, Women's Club of Belleville, Ill., "Plants of Old Mexico"; May 6, afternoon, Women's Club of Nashville, Ill., "Gardens of Florida", evening, St. Louis Hills Garden Club, "Plants of Old Mexico"; July 5, meeting of Cactus & Succulent Society of America, St. Louis, "Adventures in Cactus-Land"; Aug. 28, Cactus and Succulent Club of Chicago, "Plants of Old Mexico"; Oct. 17, Delphinium Circle of the Rosemary Garden Club, "Plants of Old Mexico"; Nov. 12, Holy Name Society, St. Pius Branch, "Gardens of Florida"; Nov. 14, Better Gardens Club of Kirkwood, "Cacti Make Good House Plants"; Nov. 18, Garden Club of St. Louis, "A Cactus Hunt in Old Mexico"; Nov. 25, St. Louis Nature Study Society, "Adventures in Cactus Land."

Dr. David C. Fairburn, Horticulturist to the Garden: April 1, St. Louis Hills Garden Club, "Spring Gardening"; April 4, St. Louis Horticultural Society, "New Annuals and Perennials for St. Louis"; Oct. 9, Des Moines Garden Club, "The Selection and Care of House Plants"; Oct. 10, horticultural staff of Iowa State College, Ames, "The Missouri Botanical Garden"; Dec. 5, St. Louis Horticultural Society, "House Plants".

Mr. Paul A. Kohl, Floriculturist to the Garden: Feb. 4, Garden Club of St. Louis, "Seed Catalogs"; Feb. 5, Emmau Lutheran School, "The Four Seasons in the Garden"; Feb. 21, Clayton Garden Club, "A Tour of the Missouri Botanical Garden"; April 1, Garden Club of Ladue, "Propagation and Division of Perennials"; May 5, Northwoods Garden Club, "Roses"; Nov.

13, joint meeting of University City Garden Club and University City Women's Chamber of Commerce, "The Missouri Botanical Garden".

Dr. George T. Moore, Director of the Garden: Radio Station KFUO, Jan. 8, "Services of the Garden to the Community"; Jan. 15, "Services of the Garden to the Botanical and Horticultural World"; Feb. 6, Station WIL, "Orchids"; March 22, Station KMOX, "There's Sunshine in the Air"; April 3, Ladies' Aid Society of Zion Evangelical Church, "Mr. Shaw and His Garden"; April 6, Station KSD, "The Case Against Smoke"; May 5, Kansas City Garden Club, "Henry Shaw and His Garden"; Dec. 11, Biology Division of the University of Illinois, "The Missouri Botanical Garden as a Scientific Institution."

Mr. George H. Pring, Superintendent of the Garden: Jan. 16, Men's Club of Tyler Place Presbyterian Church, "A Trip Over the Andes of South America"; Jan. 19, Fellowship Group of the Central Presbyterian Church, Clayton, "Experiences in Plant Collecting"; Feb. 4, Catholic Women's League, "What to Plant in the Garden"; Feb. 14, Alton Women's Council, Alton, Ill., "The Relation between Flowers and Insects"; "Four Seasons in a Garden," Feb. 17 and 18, at the Joseph Brown and O'Keefe High Schools, Atlanta, Georgia, Feb. 21, St. Louis Nature Study Society; March 2, Shaw Avenue Lutheran Church, "Plant Curiosities"; March 4, Inspirational Club, Railroad Branch Y. M. C. A., "Economic Plants"; March 4, St. Clair County Garden Club, East St. Louis, Ill., "Weed Clearance"; March 12, afternoon, Confederate Memorial Society, "Spring Planting", evening, St. Louis Garden Club, "Breeding of Water-lilies"; March 13, Radio Station KWK, "Spring Planting"; March 14, Station KSD, "A Preview of the St. Louis Flower Show"; March 15, Station KMOX, an interview with Prof. Quiz, "The St. Louis Flower Show"; March 16, Station KSD, "The Flower Show"; April 1, Greater St. Louis Association of Gardeners, "Breeding Water-lilies"; April 22, Girls' Friendly Society of St. Peter's Church, "The Garden in Bloom throughout the Year"; May 21, Carondelet Forum of the Y. M. C. A., "Romance of the Plant World"; Sept. 2, St. Clair County Garden Club, Belleville, Ill., "The Life of Henry Shaw"; Oct. 2, Ladies' Aid Society of St. Peter's Evangelical Church, "Romance of Flowers"; Nov. 23, Sunday Breakfast Club of the Downtown Y. M. C. A., "The Missouri Botanical Garden."

HERBARIUM

The herbarium has completed another satisfactory year. It has continued to grow and expand, and to maintain relatively uniform proportions of growth among all the larger groups of plants. Important collections have been received from practically all parts of the United States, and from

Mexico, Central and South America. Moreover, the use and influence of the herbarium have extended throughout the country.

There have been no large bequests during the year; but the final consignment of the Drushel Herbarium, a gift which was announced but not included in the totals in the report for 1940, was received in April of the present year. While the Drushel Herbarium has not yet been incorporated with the permanent collections of the Garden, it it evident that the number of specimens will run considerably in excess of the original estimate of ten thousand.

The larger and more significant collections which add most to the Garden's representation of the American flora are as follows:

New Accessions.—Paul Allen, 104 plants of Panama; Edgar Anderson, 102 plants of eastern United States and of Horticulture; Arnold Arboretum, 76 plants of southern United States and Panama; Fred Barkley, 340 plants of Montana; A. J. Breitung, 228 plants of Saskatchewan; J. F. Brenckle, 66 plants of North and South Dakota; Louis Brenner, 113 plants of Missouri and Mississippi; California Academy of Sciences, 58 plants of California and the Galapagos Islands; Carnegie Institution of Washington, 88 plants of California; Henry S. Conard, 30 liverworts of Iowa; William B. Cooke, 202 plants of California; Cornell University, 100 plants of southern and western United States; V. L. Cory, 16 plants of Texas; Arthur Cronquist, 600 plants of Idaho; Hugh C. Cutler, 303 plants of southwestern United States, Mexico and Cuba; William A. Dailey, 60 plants of Kentucky, etc.; G. D. Darker, 89 plants mostly from Ontario, Canada; Otto Degener, 291 plants of the Hawaiian Islands; Delzie Demaree, 2,023 plants of Arkansas; J. A. Drushel Estate, 10,300 (estimate) plants of the United States; Duke University, 250 plants of North Carolina; R. O. Erickson, 25 plants of Missouri; Robert A. Evers, 131 plants of Illinois; Walter J. Eyerdam, 278 plants of Alaska; Field Museum of Natural History, 90 plants chiefly from Guatemala; Frank A. Gilbert, 43 plants of West Virginia; Frank W. Gould, 147 plants of California; Fred W. Gray, 203 Lichens of West Virginia, North and South Carolina; Gray Herbarium, 326 plants of the United States and the West Indies; J. M. Greenman, 34 plants of Missouri including photographs of type specimens; H. A. Hawk, 35 plants of Oklahoma; A. A. Heller, 477 plants of western United States; F. J. Hermann, 41 plants of Delaware, Maryland, and Virginia; A. L. Hershey, 29 plants of New Mexico; George B. Hinton, 1,000 plants of Mexico; Harry Hoogstraal, 46 plants of Mexico; Leslie Hubricht, 575 plants of Missouri, Arkansas, and southeastern United States; Leslie James, 26 plants of Alabama; B. A. Krukoff, 1,354 plants of South America; Ethel H. Looff, 115 plants of Kodiak Island,

Alaska; C. L. Lundell, 375 plants of Mexico and British Honduras; Massachusetts State College, 239 plants of New England and of Horticulture; Montana State University, 60 plants of Montana; Museo Nacional de Historia Natural, Santiago, Chile, 150 plants of Chile; New York State Museum, Albany, New York, 250 plants of New York; Gerald B. Ownbey, 16 Senecios of Wyoming; George Harry Pring, 74 plants of cultivated orchids; Rocky Mountain Herbarium, 211 plants of Alaska; Robert W. Schery, 359 plants of Mexico; J. William Thompson, 734 plants of Washington; United States Department of Agriculture, Bureau of Plant Industry, 249 flowering plants of Nevada and 183 Fungi from various regions; United States National Museum, 259 plants of Arizona, Virginia, Mexico, Central America, and Venezuela; University of California, 51 flowering plants of South America and 169 Algae from various regions; University of Iowa, 24 Fungi from Maine, Virginia, Iowa, Central and South America; University of Kentucky, 100 plants of Kentucky; University of Michigan, 199 plants from Mexico, British Honduras, and India; University of Tennessee, 100 plants of Tennessee, Virginia, and Wyoming; University of Washington, 714 plants of eastern United States and Mexico; University of West Virginia, 100 plants of West Virginia; Utah State Agricultural College, 73 plants of Utah; Louis O. Williams, 346 Orchids of Mexico and Central America; R. E. Woodson, Jr., 2,175 plants of Panama.

Many smaller accessions have been received during the fiscal year; these have been recorded in the current monthly issues of the MISSOURI BOTANICAL GARDEN BULLETIN.

Mounting and Insertion of Specimens.—The mounting of herbarium specimens has continued throughout the year, but this work was unfortunately interrupted by the illness and death of Mrs. L. Cherney, who for many years served conscientiously and efficiently in this capacity. In June of the present year the services of Mrs. Nettie May Bauer and Miss Violet Bauer were obtained and the mounting since that time has averaged upwards of 2,000 sheets per month. Altogether 17,997 specimens have been mounted and incorporated in the general herbarium during the year. The insertion of all this new material has been done chiefly by Dr. E. C. Berry, who also has rendered valuable assistance in general herbarium work. Furthermore, Dr. Berry has determined and interpolated in the general herbarium many collections of Lichens.

Exchanges.—Special effort has been made to expedite the exchange of duplicate herbarium material. Thus, during the year, 6,565 herbarium specimens have been sent to institutions and to individuals on the basis of

exchange. Meanwhile, the herbarium has received from correspondents 6,899 specimens.

World conditions, however, have made it impracticable to continue during the year exchanges with foreign institutions. A relatively large number of duplicates intended for European herbaria with which the Garden has long maintained exchanges are held until stable conditions again prevail.

Field Work.—Considerable field work has been carried on by members of the staff and by graduate students. Valuable material has been acquired in this manner, particularly plant material which is essential to the study of special groups of plants now under critical investigation.

Use of the Herbarium.—The herbarium is in daily use for reference, and has served a relatively large number of local botanists and many who have come from distant parts of the country to consult special collections here preserved. There has been also an increasing number of requests for the loan of herbarium specimens for monographic study by specialists and by graduate research students of Taxonomy in different universities throughout the country. To these requests prompt response has followed and many groups of plants have been loaned for critical study. Likewise, similar loans have been made to the Missouri Botanical Garden Herbarium for study by members of the staff and research students in the Henry Shaw School of Botany of Washington University. These loans have rendered a mutual service to both parties concerned, and scientifically important publications have been the result.

Groups of Plants Under Special Study.—Several groups of plants have received special study during the year. Among these the following are noteworthy: *Malvaviscus* by Robert W. Schery; *Tripsacum, Euchlaena, Zea,* and related genera by E. Anderson and H. C. Cutler; *Corydalis* by Gerald B. Ownbey; *Sabadilla* and related genera by Rev. Father Robert Brinker; *Clematis* by Ralph O. Erickson; *Sesbania* by Ralph Emons; *Actinella* and allied genera by L. W. Lenz; Lichens by E. C. Berry; Fungi by G. D. Darker; Fungi and Lichens by C. W. Dodge; Apocynaceae, Asclepiadaceae, and many generic groups of the Panamanian flora have been critically studied by R. E. Woodson; Compositae and other special groups by J. M. Greenman.

Statistical Summary (for the year ending December 31, 1941):

Number of specimens received during 1941:

By bequest	10,300 ±
By purchase	6,290
By gift	2,520
By exchange	6,899

By transfer	3	
By field work	1,759	
Total	27,771	
Number of specimens mounted and incorporated in 1941		17,997
Number of specimens carried forward from 1940		1,327,895
Total number of specimens in herbarium		1,345,892

LIBRARY AND PUBLICATIONS

Although fewer books and pamphlets were catalogued in 1941 than in any recent year, the year stands out as one of great material advancement. In the history of the library, the annual appropriation has been mainly used for the purchase of books, and everything needed that could be obtained was purchased. However, since only a minimum amount was spent on binding and general upkeep of the library, some of the old volumes had fallen into disrepair and many valuable serials had been merely tied up in volumes on the shelves.

In 1941, through a special grant from the Board of Trustees, a great restoration took place. The walls and woodwork in the north wing of the administration building were painted. While the books were off the shelves they were all cleaned and shifted so as to provide more space in the most crowded sections. A former European bookbinder, who does excellent work, has rebound or restored 372 books, a large part of which were in the folio room where the most valuable collections were housed. The difference in the appearance of this room is almost startling, to say nothing of the benefit to the books. In addition, most of the serials on the first floor that had been left unbound for years were placed in "Magafiles", a patented cardboard product that keeps the books dust-proof and is very neat and durable. About 3,700 of these have been used, and all labelled with titles, volume numbers, and dates. Over 2,000 pamphlet covers were also purchased, about half of which have been inserted so far. All this is in addition to the annual binding of books and periodicals, 680 books having been bound by our regular binder.

The decrease in books catalogued in 1941 does not mean a proportional decrease in books received. It means that the time of the librarians has been spent in making a survey, collating the books for binders, checking them before and after binding, placing them on the shelves, inserting them in magazine files or pamphlet holders, labelling, shifting, inserting 600 new section labels, etc. All during the process the routine work of the library was not interrupted, and visitors or telephone calls seeking garden information were still taken care of. One of the assistants who has charge of looking after the amateur gardening-course registration and of the Garden pub-

lications was on leave of absence for eight weeks, and her work had to be divided among the other members of the staff. Naturally, the cataloguing had to be deferred for a while.

As is to be expected, fewer foreign publications were received in 1941. The Smithsonian Institution now accepts shipments only to South and Central America, Great Britain, Australia, New Zealand, India and South Africa, which means of course that we are receiving scarcely any European journals on an exchange basis. Our foreign subscription agent, Martinus Nijhoff, of the Hague, Netherlands, is purchasing the European serials for us and is holding them for the duration of the war. In that way our sets may eventually be complete.

Publications.—Volume XXVIII of the quarterly ANNALS and Volume XXIX of the monthly BULLETIN were issued during the year. The ANNALS contains 532 pages, 29 plates and 70 text-figures, the BULLETIN 305 pages, 65 plates and 29 text-figures. Several of the bulletins were of unusual popular interest and an additional quantity were ordered to be sold as single copies. Among these were the March number on "Water-lilies"; the April number on "Plant Propagation"; the June number on "The History of the Cactus and Succulent Plant Collection at the Missouri Botanical Garden"—this being issued in commemoration of the first meeting of the Cactus and Succulent Society, which was held in St. Louis, July 4-6; the September number on "Historic Trees of Missouri"; the November number on "Evergreens for St. Louis"; and the December one on "House Plants." The water-lily bulletin represented an innovation in that it carried colored illustrations of sixteen hybrids originated at the Garden. The illustrations were afterwards reproduced on post-cards which are on sale at the Main Gate. In April, a re-issue of "A Tour of The Missouri Botanical Garden" was printed. The present issue has the same reading matter as the old one, but bears a portrait of Henry Shaw on the cover and contains almost twice as many illustrations. The price of this publication is 25 cents.

Since the first volume in 1913, the subscription to the BULLETIN has not been raised from the original price of one dollar a year, with individual numbers 15 cents and some special numbers 25 cents. However, this has represented a loss which would have been considerable were it not for the sale of special numbers. It is now felt that the BULLETIN is well enough known and appreciated to charge $1.50 a year for it, and starting with the January number that price will go into effect.

The annual mailing of the ANNALS reprints took place in December, when 950 reprints were sent to 252 botanists and institutions. Many important papers are received in exchange.

The Garden publications are also sent on subscription. The total receipts for the year for ANNALS, BULLETINS, reprints, and post-cards were $2,887.81. One hundred and fifty-seven copies of Steyermark's "Spring Flora of Missouri" were sold in 1941.

Accessions.—Although some foreign book catalogues are still being received, few of the Garden *desiderata* have been listed, and the number of books purchased has been unusually small. Current books have, of course, been bought from North American dealers, and many important gifts have been received. Following is a list of some of the more outstanding accessions in 1941: Anderson, Edgar. Replies to questionnaire on "Genus Problem". 1937; Bailey, L. H. and Ethel Zoe Bailey. Hortus Second. 1941; Bonpland, Aimé. Description des plantes rares cultivées à Malmaison et a Navarre. 1813; Campbell, D. H. The evolution of the land plants. 1940; Carpenter, J. Richard. An ecological glossary. 1938; Clausen, Keck & Hiesey. Experimental studies on the nature of species. I. Effect of varied environment on western North American plants. (Carnegie Inst. Wash. Publ. No. 520). 1941; Dobzhansky, Theodosius. Genetics and the origin of species. 2nd rev. ed. 1941; Ehrenberg, C. G. Verbreitung und Einfluss des mikroskopischen Lebens Sud- und Nord-Amerika. 1843; Fuller, Harry J. The plant world. 1941; Grove, W. B. British stem- and leaf-fungi (Coelomycetes). Volume 2. 1937; Index Londinensis. Supplements for the years 1921-35. 2 vols. 1941; Inn, Henry. Chinese houses and gardens. 1940; Peter Kalm's travels in North America. 1937; Large, E. C. The advance of the fungi. 1940; Peck, Morton E. A manual of the higher plants of Oregon. 1941; Pirone, P. P. Maintenance of shade and ornamental trees. 1941; Quinn, Vernon. Shrubs in the garden and their legends. 1940; Reed, Howard S. A short history of the plant sciences. 1942; Rodgers, Andrew D. III. "Noble Fellow", William Starling Sullivant. 1940; Rothamsted Experimental Station. Memoirs on agricultural science. Vol. 23. 1941; Royal Society of New Zealand. Transactions and proceedings. Vol. 1, 1868; and Vols. 11-12, 15-22, 1878-1889; Stoddard, Herbert L. The Bobwhite quail. 1941; Tidestrom, Ivar, and Sister Teresita Kittell. A flora of Arizona and New Mexico. 1941; Vaillant, George C. Aztecs of Mexico. 1941; Verrill, A. H. and O. W. Barrett. Foods America gave the world. 2nd imp. 1931; Williams, R. O. and R. O. Williams, Jr. The useful and ornamental plants in Trinidad and Tobago. 3rd rev. ed. 1941; Withering, William. An account of Foxglove and some of its medical uses. 1785.

Important new serials received during the year in exchange for the ANNALS were: Auckland Institute and Museum, Bulletin; Bragantia

(Instituto Agronomico Estado Sao Paulo, Boletin Tecnico); Caldasia (Publication of Instituto de Ciencias Naturales de la Universidad de Colombia); Revista de la Sociedad Mexicana de Historia Natural; Revista del Museo de la Plata, Sección Botánica.

Visitors.—In addition to the staff and students in the Shaw School of Botany, the following out-of-town botanists and horticulturists have visited the Garden library during the year: Mr. Walter Adams, Associate Editor, *Better Homes and Gardens*, Des Moines, Iowa; Mrs. L. Sherman Adams, of the L. Sherman Adams Co., Orchid Growers, Wellesley, Mass.; Dr. E. G. Anderson, Geneticist, California Institute of Technology, Pasadena; Dr. Fred A. Barkley, Instructor in Botany and Curator of the Herbarium, University of Montana, Missoula; Dr. Earl E. Berkley, Associate Cotton Technologist, U. S. Dept. Agr., Washington, D. C.; Dr. Albert P. Blair, National Research Fellow, Columbia University, New York City; Mr. C. B. Breedlove, Biology Teacher, Amarillo Public Schools, Amarillo, Texas; Dr. K. S. Chester, Head Department of Botany, Oklahoma Agricultural & Mechanical College, Stillwater; Prof. Lewis Clevenger, Professor of Biology, State Teachers' College, Kirksville, Mo.; Dr. Elzada U. Clover, Instructor in Botany and Assistant Curator Botanical Gardens, University of Michigan, Ann Arbor; Dr. Lincoln Constance, Assistant Professor of Botany, University of California, Berkeley; Dr. George W. Corner, Director Department of Embryology, Carnegie Institution of Washington, Baltimore, Md.; Mr. C. J. Coukos, Assistant Agronomist, Soil Conservation Service, U. S. Dept. Agr., Elsberry, Mo.; Dr. Hugh C. Cutler, Research Fellow, Shaw School of Botany; Dr. Theodosius Dobzhansky, Professor of Genetics, Columbia University, New York City; Fr. Arthemè Dutilly, Naturalist of the Arctic Missions and Research Associate in Biology, Catholic University of America, Washington, D. C.; Mrs. Wanda K. Farr, Research Chemist, American Cyanamide Co., Stamford, Conn.; Sister Muriel Flamman, Instructor in Botany, Seton Hill College, Greensburg, Pa.; Dr. Harry J. Fuller, Associate Professor of Botany, University of Illinois, Urbana; Dr. Reginald R. Gates, formerly of the University of London, England; Mr. and Mrs. Howard Scott Gentry, collectors of tropical plants; Mr. Alfred H. Gilbert, District Conservationist in Erosion Control Work, U. S. Dept. Agr., Mayfield, Ky.; Dr. George B. Happ, Professor of Biology, Principia College, Elsah, Ill.; Mr. Roland M. Harper, Geographer, Geological Survey of Alabama, University, Ala.; Mr. Eugene S. Heath, Director, Georgia Botanic Garden, Atlanta; Dr. George Thomas Johnson, John Simon Guggenheim Research Fellow, Washington, D. C.; Dr. Donald F. Jones, Plant Geneticist, Conn. Agr. Exp. Sta., New Haven; Dr. E. P. Killip, Associate Curator, U. S. National Herbarium,

Smithsonian Institution, Washington, D. C.; Dr. Mary Maxine Larisey, Assistant Professor of Biology, Judson College, Marion, Ala.; Mr. William C. Leavenworth, Assistant in Botany, University of Illinois, Urbana; Mr. Philip Leyendecker, Graduate Student, Iowa State College, Ames; Dr. Carl C. Lindegren, Assistant Professor of Bacteriology, University of Southern California, Los Angeles, Calif.; Mr. Benjamin Lowenhaupt, Graduate Student, University of Chicago; Dr. G. W. Martin, Professor of Botany, University of Iowa, Iowa City; Dr. Mildred Mathias (Mrs. Gerald Hassler), Research Associate, University of California, Berkeley; Mr. R. C. Mauldin, of the Associated Seed Growers, Inc., San Antonio, Texas; Mrs. R. C. Mauldin, in charge of Seed Laboratory, Soil Conservation Service, U. S. Dept. Agr., San Antonio, Texas; Mr. J. L. McMullen, in charge of Biological Sciences, North Idaho Junior College, Coeur d'Alene; Dr. C. V. Morton, Assistant Curator, U. S. National Herbarium, Smithsonian Institution, Washington, D. C.; Mr. B. Y. Morrison, Horticulturist in charge of Plant Introduction, U. S. Dept. Agr., Washington, D. C.; Dr. E. E. Naylor, Assistant Professor of Botany, University of Missouri, Columbia; Miss Helen Neuman, Graduate Student, University of Cincinnati, Ohio; Dr. Marion Ownbey, Instructor in Botany and Curator of Herbarium, State College of Washington, Pullman; Dr. George K. Parris, Plant Pathologist, Hawaii Agr. Exp. Sta., Honolulu; Dr. Elizabeth M. Pinkerton, Medical Mycologist and Allergist, New York City; Professor C. L. Porter, Head Department of Botany, Purdue University, Lafayette, Ind.; Dr. John N. Porter, Assistant Professor of Botany, University of Puerto Rico, Mayaguez; Dr. W. O. Richtmann, Professor of Pharmacy, University of Wisconsin, Madison; Mr. Andrew Denny Rodgers, III, of Columbus, Ohio; Mrs. Charles E. St. John, of Boston, Mass.; Miss Ruth D. Sanderson, Librarian, Gray Herbarium of Harvard University; Dr. A. F. Satterthwait, U. S. Dept. Agr. Ent. Lab., Urbana, Ill.; Dr. Henry Schmitz, Dean of School of Forestry, University of Minnesota, St. Paul; Mr. Robert M. Senior, of the Cincinnati Natural History Society, Ohio; Dr. Ward M. Sharp, Manager, Valentine National Wild Life Refuge, Valentine, Nebr.; Dr. Julian F. Smith, Associate Director, Hooker Scientific Library, Central College, Fayette, Mo.; Dr. E. R. Spencer, Professor of Botany, McKendree College, Lebanon, Ill.; Mr. Hugh A. Steavenson, Associate Horticulturist, Soil Conservation Service, U. S. Dept. Agr., Elsberry, Mo.; Mr. T. R. Stemen, Teacher of Biology, Classen High School, Oklahoma City, Okla.; Dr. J. A. Steyermark, Assistant Curator of the Herbarium, Field Museum of Natural History, Chicago; Dr. Carl Swanson, Fellow, Department of Plant Breeding, University of Missouri, Columbia; Dr. Delbert Swartz, Professor of Botany, University of Arkansas, Fayetteville; Dr. A. G. Vestal, Professor of Botany, University of Illinois, Urbana;

Prof. C. E. Wilden, in charge of Floriculture, Michigan State College, East Lansing; Mr. H. L. Westover, Principal Agronomist, Division of Forage Crops, U. S. Dept. Agr., Washington, D. C.; Dr. F. Lyle Wynd, Assistant Professor of Botany, University of Illinois, Urbana.

In addition, the following school groups were among those visiting the Garden library during the year: students in botany at Moberly Junior College, Moberly, Mo., in charge of Miss Esther Adams, instructor in biology; two groups of biology students from Principia College, Elsah, Ill., accompanied by Mr. John Wanamaker, instructor in biology; class in botany from Southern Illinois Normal University, Carbondale, Ill., with Prof. Walter B. Welch, professor of botany, in charge; University of Illinois Library School, with Miss Rose B. Phelps, of the Faculty, in charge; biology class of East Alton-Wood River Community High School, Wood River, Ill., accompanied by Mr. W. E. Hopper, instructor in biology; the members of the Cactus and Succulent Society of America attending the first meeting of the convention held in St. Louis.

The library also loans books on the inter-library loan plan, 136 such loans having been made to 22 institutions during the year.

Statistical Summary.—There have been donated to the library or received in exchange during the year 282 books valued at $689.81 and 759 pamphlets valued at $133.70. One hundred books were bought at a cost of $516.26, and 5 pamphlets at a cost of $2.75. The library now contains 54,400 books and 86,350 pamphlets. There are 349 manuscripts valued at $1,709.70 and 1,078,495 index cards valued at $13,608.90. A total of 8,813 cards were added during the year, of which 664 were written by Garden employees, and 8,149 were purchased at a cost of $172.83. Six hundred and eighty books were bound and 372 were rebound or repaired. There were 3,696 magazine files purchased and 2,110 pamphlet covers.

ANNUAL BEQUESTS

The annual flower sermon "On the wisdom and goodness of God as shown in the growth of flowers, fruits, and other products of the vegetable kingdom," provided for in the will of Henry Shaw, was preached by Dr. Rufus M. Jones, of Haverford, Pa., emeritus professor of philosophy, Haverford College.

The Gardeners' Banquet Fund was used to provide turkeys for employees at Christmas.

ATTENDANCE FOR 1941

(Not including visitors to Arboretum)

	Week-days	*Sundays*
January	6,367	7,345
February	7,299	9,194
March	6,282	9,781
April	12,955	15,155
May	24,362	16,354
June	17,732	13,742
July	22,306	11,737
August	26,308	15,095
September	17,657	14,767
October	18,020	11,649
November	18,627	18,734
December	5,696	4,286
Total	183,611	147,839
		183,611
Total		331,450

GEORGE T. MOORE,
Director.

STATISTICAL INFORMATION FOR DECEMBER, 1941

GARDEN ATTENDANCE:	
Total number of visitors	9,982
PLANT ACCESSIONS:	
Total number of plants and seed packets received as gifts	376
LIBRARY ACCESSIONS:	
Total number of books bought	8
Total number of books and pamphlets donated	38
HERBARIUM ACCESSIONS:	
By Purchase—	
Degener, Otto—Plants of Hawaii	291
Lundell, C. L.—Plants of Mexico and British Honduras	275
By Gift—	
Allen, Paul H.—Plants of Panama	11
Anderson, Edgar—Plants of Horticulture	5
Darker, G. D.—Plants of Ontario, Canada	76
Erickson, Ralph O.—*Parmelia conspersa* (Ehrh.) Ach. from Missouri	3
James, Leslie—Plants of Alabama	3
Murrill, W. A.—*Salix* sp. from Florida	1
Pring, George H.—Orchids of Horticulture	72
Trovillo, Mrs. H. E.—*Crataegus* sp. from Missouri	1
Weatherwax, Paul—Plants of Horticulture	6
Woodson, R. E.—Plants of Panama	2
By Exchange—	
Duke University—Plants of North Carolina	250
U. S. National Museum—Plants of Virginia	159
Total	1,155

ANNOUNCEMENT

A. D. E. Elmer's "Leaflets of Philippine Botany"

for sale by the Missouri Botanical Garden

"Are the 'Leaflets of Philippine Botany' in your library? Every botanical institution should have them, and at the present time I can offer for sale complete series of the ten published volumes including a general index for the entire works. Remember, this publication will no longer be published. Its average price is $11.00 for each volume."

A. D. E. Elmer.

All of the available sets of Elmer's "Leaflets of Philippine Botany" have been deposited at the Missouri Botanical Garden. A few complete sets are available, and practically any of the single leaflets may be obtained at 5c a page.

Orders may be sent direct to the

Missouri Botanical Garden
2315 Tower Grove Avenue
St. Louis, Missouri

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by

Julian A. Steyermark

"A book that is complete. . . . Undoubtedly the book Missouri flower-lovers have been looking for."

Missouri Historical Review

". . . In short, the *Spring Flora of Missouri* is the best 'Spring Flora' available at present in the United States."

American Midland Naturalist

"Should be of great use to local garden clubs, and for the scientific worker who is concerned with the local flora it should be invaluable."

National Horticultural Magazine

"Carefully and critically done, so that it should find wide and enthusiastic reception at the hands of all who enjoy being acquainted with the rich native flora of Missouri."

Rhodora

"The most comprehensive spring flora ever issued for any state. . . . Notable for presenting its data in simple non-technical English, yet with thorough scientific accuracy. Book's value not limited to Missouri."

Field Museum Notes

For sale by the Missouri Botanical Garden. Price $3.00

MISSOURI BOTANICAL GARDEN BULLETIN

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OF THE MISSOURI BOTANICAL GARDEN

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SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date until his death in 1889 it was maintained under his personal direction. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was chosen by Mr. Shaw and he definitely indicated that he wished it called by that name. The Garden passed at his death into the hands of a Board of Trustees, designated in Mr. Shaw's will, and the Board so constituted, exclusive of certain ex-officio members, is self perpetuating. By a further provision of the will the immediate direction of the Garden is vested in a Director, appointed by the Board. The Garden receives no support from city or state but is maintained almost exclusively from the estate left by Henry Shaw. Since 1939 many Garden Clubs and interested individuals have contributed to a "Friends of the Garden Fund" which is used in developing the new Arboretum, located at Gray Summit, Mo. The Arboretum (1) serves as a source of plants, trees and shrubs for the city Garden; (2) affords areas for gradually establishing a pinetum, a wild-flower reservation and various other features on a scale not possible in the city; (3) provides greenhouses for some 20,000 orchid plants.

The city Garden comprises 75 acres, where about 12,000 species of plants are grown, both out of doors and under glass. It is open every day in the year except New Year's Day and Christmas; week days, 8:00 a. m. until sunset; Sundays, 10:00 a. m. until sunset. The greenhouses are closed every day at 5:00 p. m.

The main entrance to the Garden is at Tower Grove Avenue and Flora Place, on the Sarah car line (No. 42). The Tower Grove bus (No. 21), direct from downtown, passes within three blocks of the main entrance.

DENDROBIUM BIGIBBUM
(Imported from Australia)

DENDROBIUM PHALAENOPSIS var. SCHROEDERIANUM
(From seed, St. Louis)

Missouri Botanical Garden Bulletin

Vol. XXX FEBRUARY, 1942 No. 2

ORCHIDS AT THE MISSOURI BOTANICAL GARDEN

Ever since Mrs. Henry T. Blow presented Henry Shaw with orchid plants collected by her in Brazil, these flowers have afforded one of the favorite displays at the Garden. This gift, probably made in the early seventies, furnished the nucleus for the collection which to the time of Henry Shaw's death in 1889 was one of the most complete of its kind in the country, at least so far as species were concerned. In the 7th ANNUAL REPORT of the Garden, covering the year 1896, Professor Trelease wrote:

> "Among other things a small but carefully selected collection of orchids has been placed in the house built in 1894, so that by good management there will scarcely be a time when one or more of these interesting plants cannot be found in bloom. . . . . This collection will be extended considerably from year to year, my intention being to devote the greater part of this house to a varied collection of orchids."

That this intention was carried out is evidenced by the fact that while in 1895 there were only about 150 species of orchids in the collection, by 1899 this had grown to 548 species. Towards the end of the year 1903 a fire destroyed a large part of the collection and seriously injured the remainder, so that it was necessary to re-establish orchids at the Garden. A welcome addition was a gift of 84 plants, representing 78 species, from the New York Botanical Garden through Dr. N. L. Britton, the Director.

The first illustration of orchid flowers in one of the ANNUAL REPORTS appeared in 1903 when a full-page plate was used showing three flowers of *Trichopilia suavis*. By 1905 the Garden collection was pronounced by "an expert dealer" as being the largest in the United States. Many of these plants were collected by Director Trelease who visited Mexico and Central America for the purpose. That the vanilla orchid succeeded remarkably well at the Garden is evidenced by two illustrations in the ANNUAL REPORT for 1909, showing flowers and some dozens of mature pods. In that year the orchid collection consisted of 640 species and varieties and 99 genera, and it remained at about this status for some time.

With the publication of a monthly BULLETIN the Garden had a better opportunity of publicizing its orchids, and the frontispiece of the December 1913 issue shows two or three dozen plants in bloom that month. The old Cycad House south of the fern dome was rearranged to accommodate the collection, which contained about 800 species and varieties at that time. The records for 1913 show that the number of blossoms varied from 64 in January to 12 in October, the total for the year being 278. This, it must be confessed, was close to the actual number of conspicuous flowers produced as there were few duplicates. Each succeeding year the BULLETIN carried in increasing numbers illustrations of orchid flowers that were worthy of special mention. Any increase in the collection was limited to purchases amounting to not more than $500.00 a year and to such propagations as could be made from old plants.

This situation continued until the spring of 1918 when Mr. D. S. Brown, of Kirkwood (a suburb of St. Louis), donated to the Garden all of his orchid plants, with the exception of the Cypripediums. This most notable gift included nearly 200 species and varieties, and the Garden was now supposed to have the most complete collection of orchid species in the United States, about 700 species being represented. Some of the more worthwhile plants were *Cattleya Dusseldorfi* var. "Undine", with its parents *C. intermedia alba* and *C. Mossiae Wageneri*, *Brassocattleya Veitchi* var. "Queen Alexandra", *C. Skinneri* var. *alba*, *Dendrobium virginale*, as well as *Brassolaelia*, *Sophrocattleya*, and *Laeliocattleya* hybrids. For more than thirty years Mr. Brown had been interested in acquiring rare and valuable orchid plants, and the collection had come to be recognized as one of the finest of its kind in the country. Consequently, through Mr. Brown's generosity the Garden orchids took on new significance. To cap the climax, in the fall of the same year Mr. Brown presented the remainder of his collection consisting of Paphiopedilums (Cypripediums) and Phragmopedilums (Selenipediums), including many rare specimens which at that time could only be duplicated with the greatest difficulty. Supplemented in this magnificent fashion, at the end of the year 1918 the Missouri Botanical Garden orchid collection included some 5,732 plants representing 1,235 species, varieties, and hybrids.

With the addition of the Brown collection, it became possible, as never before, to stage special floral displays of orchids. In December, 1918, the Christmas floral display contained several hundred orchid plants in bloom, the largest exhibit of epiphytic plants ever held in St. Louis, comparing favorably with displays in the East. Mr. Brown's favorite Slipper Orchid dominated the exhibition and included the hybrid "Sidney Brown", a cross between *Paphiopedilum (Cypripedium) insigne Eyermanni* and *P. nitens Leeanum*, as well as others of his creation. *Paphiopedilum Holdeni* and *P.*

STAR OF BETHLEHEM

(Angraecum sesquipedale)

BUCKET ORCHID
(Coryanthes macrantha)

Maudiae, green hybrids which at the time were rare, were imported from England. Additional genera represented in the first orchid show at the Garden were Angraecum, Lycaste, Coelogyne, Vanda, Oncidium, Calanthe, Polystachya, Maxillaria, and Dendrobium. In 1920 the first orchid seedling produced at the Garden flowered and was named *Paphiopedilum* "D. S. Brown", in honor of Mr. Brown. The parents were *P. barbatum Crossi* and *P. Harrisianum superbum*.

By 1923 public interest in orchids had increased to an extent that the Garden seemed warranted in securing additional plants suitable for display purposes. Accordingly, Mr. G. H. Pring, then Horticulturist to the Missouri Botanical Garden, was sent to Colombia primarily to obtain *Cattleya Trianae* and *C. Schroederae*. This trip resulted in adding about 5,000 Cattleya plants to the collection, besides some 200 orchids obtained by exchange from Mr. C. W. Powell, of Balboa, Canal Zone. Of this number, some 39 species and varieties were introduced into the United States for the first time. Chiefly because of the Powell orchids, the Garden was able to enter an exhibit at the first show of the American Orchid Society, held in Boston in May, 1924. Under the classification "Orchids of Botanical Interest Not Necessarily in Flower, Covering 25 Square Feet and Embracing at Least 12 Genera", 37 genera represented by 46 distinct species were displayed, all that could be included in the allotted space. For this exhibit, which was in competition, the Garden was awarded a silver cup.

While orchid flowers had for many years constituted a part of the floral displays, the first exclusive orchid show was in November, 1924. Some of the serious difficulties in having blooming orchids at this time of year may be imagined from a quotation from the December 1924 Garden BULLETIN:

> "During the latter part of October the outlook for the orchid exhibition was not very promising. The city at that time was enveloped in a dense smoke cloud which continued for the entire week, the Garden greenhouses being filled with the fumes. All orchid buds which had penetrated their sheaths were lost and open flowers soon succumbed, being unable to withstand the noxious atmosphere. Plants in the Economic and Citrus Houses also showed damage, in some cases losing more than half their leaves. Apparently the only immediate remedy for overcoming this deplorable condition is the removal of the entire collection outside the smoke area."

Fortunately, plans were already under way, and the out-of-town extension was acquired in 1925. This was some 35 miles southwest of the city and it first comprised 1,300 acres. Since one of the most pressing reasons for securing this location was the necessity of getting the orchid plants away from the detrimental effect of a city atmosphere, the construction of a range of eight greenhouses was immediately begun. By the end of 1926 all the orchid plants were housed at this new location and almost

VANILLA FLOWERS AT TOP; RIPE PODS BELOW

WAX ORCHID

(Stanhopea Buccephalus)

immediately began to show the beneficial effect of the change. Absence of poisonous gases, an appreciable increase in the amount of sunlight in the fall and winter months, and the use of rain-water all contributed to this improvement.

Early in 1926 a trip to the Canal Zone resulted in the establishment of a Tropical Station at Balboa, and Mr. C. W. Powell presented to the Garden his worldwide-known collection of orchids. This gift, added to the plants already possessed, placed the Garden in the front rank of public institutions so far as an orchid collection was concerned. The *Orchid Review*, published in England, commenting on the establishment of the Canal Zone Station, said: "The Missouri Botanical Garden has been for a long time a strong rival of the Royal Botanic Gardens, Kew, for the premier position in orchid botanical gardens. By this latest move of theirs they have put themselves in a position to claim it and to maintain it." It soon became evident that if the Garden was to maintain this supremacy the raising of orchid seedlings would have to be undertaken on a major scale. Consequently, an orchid-seedling department was organized in 1927. Many crosses were made in our own greenhouses and seed-pods were set for us in several private collections, so that by the end of 1928 some 750 flasks had been sown and approximately 50,000 seedlings were in early stages of growth. The hybrids included those of Cattleya, Brassocattleya, Laeliocattleya, Cymbidium, Dendrobium, Miltonia, Sobralia, Stanhopea, Epidendrum, and Phalaenopsis. At the same time investigations were undertaken to improve the methods of culture, including modifications of the media, use of different strains of fungi, and other factors involved in the successful growing of seedlings.

By the time of the 4th National Exhibition of the American Orchid Society, held in Washington, D. C., October 16-18, 1930, the Garden was able to stage an exhibit showing the development of orchids from seed to blooming plant. One hundred flasks containing seedlings of twelve different genera in various stages of growth, grown both symbiotically and asymbiotically, were shown. Successive steps in cultivation from the maturing seedling to that of the flowering adult were also included. Seed-pods on different species, with seed shown under magnification, added to the completeness of the exhibit. The Mrs. F. E. Dixon silver cup was awarded to the Garden for what at the time was the most complete demonstration of the development of an orchid plant from seed, ever presented at any flower show.

By 1930 the orchid collection housed at the new extension near Gray Summit had so increased that three additional greenhouses were needed. Changing the majority of plants from wood baskets to pots saved considerable space, but the accumulation of seedlings called for more and more

EXHIBIT SHOWING DEVELOPMENT OF ORCHID FROM SEED TO MATURE PLANT.
AMERICAN ORCHID SOCIETY NATIONAL SHOW, WASHINGTON, D. C.

BULL-HEADED DENDROBIUM (*Dendrobium taurinum*)

room. Vigorous seedlings of spray orchids, such as Vanda, Oncidium, Dendrobium, etc., were now on hand, and approximately 20,000 seedlings of various Cattleya hybrids. In fact, the number of seedlings of both species and hybrids had grown to an extent not previously contemplated, and it was decided in 1931 to discontinue for a while, except to a minor degree, the growing of orchids from seed.

In this same year Dwight F. Davis, then Governor-General of the Philippine Islands, presented the Garden with about 250 Philippine orchids, many of them new to the collection.

Since 1925 it has been the practice of the Garden to present to the Veiled Prophet Queen a bouquet of mixed orchid flowers. Besides hybrid Cattleyas and others of similar size, counting each flower on sprays of Oncidium, Dendrobium, Vanda, etc., this bouquet often included as many as 500 orchids. It has become a significant feature of the Ball, and perhaps no one thing has contributed so much to making St. Louis "orchid-conscious." In 1932, for the first time, flowers from seedling plants were included. *Dendrobium Phalaenopsis* var. *Schroederianum* was pollinated on October 15, 1928, eight months being required for the maturity of the seed. These were sown in June, 1929, and three years and three months later the larger seedlings bore one or two small flowers. The succeeding year the plants produced normal spikes, bearing ten or more flowers, and these were the ones used in the Queen's bouquet.

Perhaps the outstanding achievement of the year 1934 was the discovery by Paul Allen of both the habit and habitat of *Sobralia Powelli.* A single specimen, named by Schlechter for Mr. Powell, had been obtained from a native in Panama City and every effort to learn where or how it grew had failed. Mr. Allen's fortunate find resulted in adding about a dozen plants of this species to the collection, as well as determining that S. *Powelli* was truly epiphytic and not terrestrial as had been supposed. About 1935 thirty hybrid orchid seedlings had flowered, some of them among the finest ever grown at the Garden. The number of blossoms, counting all species and varieties and each flower on a spray, had reached an annual total of 20,000. The orchid show now became a rival of the chrysanthemum show, which had long been regarded as the most popular display of the year.

The profusion of orchid flowers also made it possible to stage an outstanding exhibit at the Greater St. Louis Flower and Garden Show, held at the Arena, March 30-April 7, 1935. This occupied a frontage of nearly 60 feet and constituted one of the main attractions. Backed by a panorama of the Andes, painted from photographs taken during the Garden's expedition to Colombia in 1923, there were arranged both epiphytic and terrestrial plants, the former on trees in as nearly a natural position as possible. In an

alcove at one side were arranged 30 hybrid Odontoglossums in full bloom, sent by Sir Jeremiah Colman, well-known English orchid fancier. For this magnificent display of plants which cannot be successfully grown in St. Louis Sir Jeremiah was awarded the Henry Shaw Gold Medal. Another alcove contained choice hybrids, many from our own seedlings, as well as certain interesting "botanical species". Altogether, approximately 5,000

PISTILLATE (FEMALE) FLOWER OF SWAN ORCHID
(Cycnoches Warsceuiczi)

flowers were displayed, including such genera as Cattleya, Laeliocattleya, Brassocattleya, Vanda, Aerides, Oncidium, Cymbidium, Dendrobium, Lockhartia, Lycaste, Brassia, Epidendrum, Phalaenopsis, Maxillaria, Catasetum, Cypripedium, and Selenipedium (Paphiopedilum and Phragmopedilum).

In 1937, of more than 6,000 orchid flowers on display in the mid-winter show, 75 per cent were from seedlings grown in St. Louis. These were the

VANDA SANDERIANA

result of hundreds of crosses, many of which, of course, failed to produce viable seed. By this time 40 hybrids had reached maturity, most of them in quantity since only a few seedlings were lost from among those finally selected for growing on. Cattleya and Brassocattleya hybrids predominated but a fine group of Cymbidiums and Dendrobiums helped to make up the number.

BRASSOCATTLEYA ALBINO HYBRID GROWN FROM SEED IN ST. LOUIS

It became evident that an active return to growing orchids from seed was in order, and a special laboratory was fitted up in the Experimental Greenhouse where some thousands of seedlings have since been raised. Here also have been carried on experiments with various media, the effect of light, increased carbon dioxide, fertilizers, gravel culture, etc. At the time of the meeting of the Garden Club of America at St. Louis in May, 1937, a special exhibit of the progressive steps in orchid culture was shown and attracted much attention. Hundreds of orchid flowers of many kinds were used in decorating the head table at the banquet given for the delegates during the convention.

With the appointment of Mr. Paul Allen as Manager of the Tropical Station at Balboa, Canal Zone, in 1936, many additions were made to the

MORMODES ATROPURPUREUM

GRAMMATOPHYLLUM MULTIFLORUM

orchid collection located there. Besides a new water main, physical improvements included new racks and supports, chiefly of pipe, to replace the old wooden ones. This permitted the rearrangement of the plants according to genera which greatly aided in their care, besides making them more attractive to the public. The system of exchange with orchid growers in other tropical countries was revived, resulting during the next two years in the receipt of over 100 species not previously represented. A Sobralia hedge 250 feet in length was established along the front of the Station. During the season this carried hundreds of flowers and perfumed the air for a great distance. Numerous trips were made by the Manager into the interior of

NATIVE HOME OF SOBRALIA POWELLI

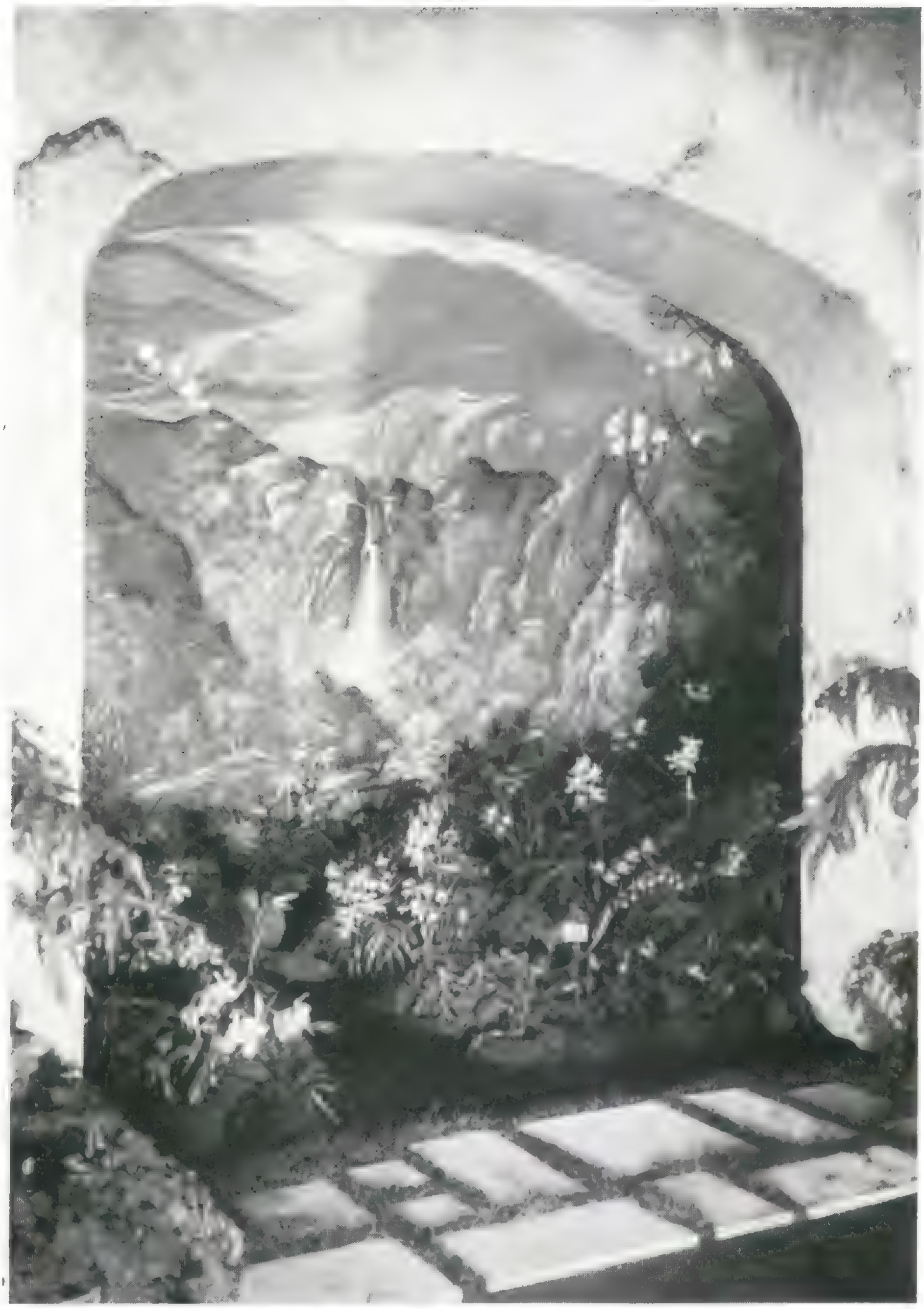
Panama for orchid plants for the Station as well as for herbarium specimens. *Cattleya Skinneri* and *C. Deckeri* were accumulated in quantity, providing a colorful show for visitors. Large shipments of *Cattleya speciosissima* from Venezuela and *Oncidium varicosum Rogersi* from Brazil were cleaned and held for a quarantine period before forwarding to St. Louis. For financial reasons it became necessary to transfer the Tropical Station maintained at Balboa to the Canal Zone Government in March, 1939. It can be imagined with what regret this project, which had been such a useful adjunct to the St. Louis Garden for twelve years, had to be abandoned. Fortunately, before this happened Mr. Allen had rediscovered the rare "Chinela" orchid *Phragmopedilum caudatum* var. *Warscewiczi* and had sent six plants by air mail to supplement the Garden collection.

The year 1939 is notable for the first flowering of two splendid additions to the collection, namely *Vandopsis lissochiloides* and *Renanthera Storiei*. The first was imported from England twenty-three years previously, and both were in the shipment sent to the Garden by Governor-General Davis from the Philippines. Another rare plant received from this source was the Bull-headed Dendrobium *(Dendrobium taurinum)*.

SOBRALIA POWELLI

At the end of 1941 a complete inventory was made of the entire orchid collection. As a result, many inferior plants were discarded, including unnamed seedlings and unnecessary duplicates. The actual count shows that there are 76 genera, represented by 1,155 species, varieties and hybrids, now in the collection. Of mature flowering plants there are 14,399. Flowers from all these plants, which were shown in the alcoves or at the orchid show, had reached a total of 19,937, of which 13,688 belonged to the Cattleya group, 4,093 sprays including such genera as Dendrobium, Oncidium, Vanda, Aerides, and Phalaenopsis, 2,156 Cypripediums, and several

CATTLEYA CITRINA



CENTRAL PANEL OF ORCHID DISPLAY,
FLOWER SHOW, ARENA, 1935.

ORCHIDS FROM SIR JEREMIAH COLMAN COLLECTION
SHIPPED IN FULL FLOWER FROM ENGLAND

hundred miscellaneous. Seedlings in pots, chiefly of various Dendrobiums and Cattleya hybrids, numbered 6,624, and over 10,000 in flasks were about ready to be transplanted.

The number and variety of orchid plants afford an opportunity to make displays of flowers which could never be duplicated in nature, since the native homes of these plants are so widely scattered, including every tropical or semi-tropical country. There is not another botanical garden in the temperate zone where so many species, hybrids and varieties of orchids may be seen in bloom throughout the year.

G. T. M.

SOME PANAMANIAN ONCIDIUMS

More than twenty Oncidiums have been described from Panama, and they vary greatly both as to size and form. The pygmy *O. iridifolium* possesses solitary flowers backed by a fan of leaves, and is without pseudobulbs. The two largest species, *O. panamense* and *O. confusum*, grow in clumps, with pseudobulbs bearing long grass-like leaves and 4- to 6-foot spikes of olive-brown flowers splotched with yellow. *Oncidium confusum* differs from all other species in its terrestrial habit, growing in the grass-covered clay banks along water courses. *Oncidium stipitatum* has a small, nut-shaped pseudobulb, from the base of which spring graceful spikes of yellow "dancing-girl" flowers and 18-inch dagger-like leaves. A contrasting form is *O. Oerstedi*, with large, leathery leaves, elliptical in shape, 1 foot long and 4 inches wide. From the base of the pseudobulb hang 4- to 5-foot spikes of small brownish-mauve flowers. *Oncidium ampliatum*, called the "Panama-Butterfly" by the natives, is the most showy of all the yellow-flowering species, its 4-foot spikes bearing over a hundred flowers, suggesting butterflies in flight. Its pseudobulbs are hard, subrotund, compressed, bearing 2 rigid strap-shaped leaves. It is commonly seen suspended from the porches or patios in the Canal Zone and in the city of Panama. However, it is gradually being exterminated by the natives, who collect the plants to sell to tourists for a few pesos.

Oncidium Powelli.—This orchid, with large chocolate-colored flowers, was purchased by the late C. W. Powell from a native collector who supposedly found it along the Pacific slopes. The following year, when it bloomed for the first time in his garden, Mr. Powell was so delighted with it that he decided to give the entire plant to science. After being dried and pressed, it was sent to Dr. Schlecter in Berlin, who reported that it was the handsomest specimen of Oncidium he had seen. He described it as a new

HOLY GHOST ORCHID
(Peristeria elata)

CRIMSON AND YELLOW ORCHID
(Vandopsis lissochiloides)

THE CHINELA

(Phragmopedilum caudatum var. *Warscewiczi)*

species, naming it *Oncidium Powelli* in honor of Mr. Powell. The plant may indeed have been preserved for science, but it was almost lost to cultivation, for all efforts to find its native habitat failed. Plants supposed to be O. *Powelli* turned out to be varieties of the yellow-flowered O. *panamense*. It was not until 1930 that the late Mr. A. Hunter, then Manager of the Missouri Botanical Garden Tropical Station at Balboa, Canal Zone, rediscovered O. *Powelli* and determined that it was not a native of the Pacific slopes but rather of the Atlantic side of the Canal Zone. This was substantiated by Mr. Paul Allen, who added that it is by far the rarest species in Panama.

Four flowering specimens, presumably the only plants in the United States, are now growing at the Missouri Botanical Garden. The pseudobulbs are oblong-ovate, compressed, 3 inches high and 2 1/2 inches wide, and bear either 1 or 2 strap-shaped leaves 10 inches long and 1 inch wide at the apex. Clasping the base of the bulb at its side is another pair of leaves. Flowers numbering 20 or more are borne upon a 3-foot vertical spike, usually in pairs at the base, solitary towards the apex. The individual blossoms, which measure 3 inches across, are of a light chocolate color, with faded yellow circular lines behind the lip. The sepals and petals are 1½ inches long, 1/2 inch wide, the margins of both being prominently undulated and showing a greenish-yellow ridge. The labellum is smaller than in most species and extends away from the perianth, being supported at the base of the vertical column. The flowers somewhat suggest the genus Odontoglossum of the "triumphans" group.

G. H. P.

LIBERTY HYDE BAILEY

(Abstracted from "An Appreciation" by David Fairchild)

"Professor Bailey is approaching his eighty-fourth year. His labors for American garden lovers are drawing to a close. The Directors of the Fairchild Tropical Garden, with which organization he has been associated since its inception and to which he has given his enthusiastic support, wish to recognize his countless gifts to the plant lovers of America by honoring him with a suitable memorial. At the same time they wish to impress upon the children and youth who see it the fact that there lived a man who saw clearly that unless we take care of the world of plants, our civilization cannot be the beautiful one of our dreams.

"It seemed to them that it should be a living, growing monument, and they have decided that nothing could be more appropriate than to make in

ONCIDIUM FULGENS

ONCIDIUM POWELLI

Professor Bailey's honor a great Palm Glade here on the shore of Biscayne Bay.

"Those of us who have watched the growth of the large collections of palms already assembled here and who have witnessed the transformation wrought on the low lands bordering the Bay when the modern dredging machine and the landscape artist and the palm specialist combine their skills, know how beautiful the result can be.

"In a few years we could have here a glade of tropical palms which would do full honor to Professor Bailey's memory and be a Mecca for thousands of garden lovers making pilgrimages to South Florida to see what tropical palms really are. These many visitors are familiar with the name of L. H. Bailey and, finding him honored here by a tribute to his passion for palms, would be impressed anew with the greatness of his contribution to the peace and beauty of the world.

"Dr. Bailey is a figure of national and international importance and it is planned that this memorial shall be the gift of the greatest possible number of his friends and admirers. To this end it has been decided *that no contribution shall be of more than one dollar*. It is hoped that on Dr. Bailey's 84th birthday, March 15, 1942, the Palm Glade can be dedicated and an album be placed in his hands inscribed with the names of all those who feel indebted to his life's activities and have subscribed to the Glade.

"Subscriptions can be made out to the Liberty Hyde Bailey Palm Glade and sent to the Fairchild Tropical Garden, Coconut Grove, Florida."

NOTES

Mr. Ladislaus Cutak, in charge of Succulents at the Garden, has been appointed one of the regional vice-presidents of the Cactus and Succulent Society of America.

Mr. Ladislaus Cutak gave an illustrated lecture before the St. Louis Horticultural Society, January 2, on "Gardens of Florida."

Mr. George H. Pring, Superintendent of the Garden, gave a lecture at Michigan Agricultural College, East Lansing, February 4, on "The Breeding of Water-lilies."

Dr. Edgar Anderson, Geneticist to the Garden, is the author of an article "Vegetable Gardening in St. Louis," published in the February number of *Garden Life* (**15**:13).

The annual flower sermon, provided for in the will of Henry Shaw, was preached by Dr. Maude Royden, famous woman preacher of England, at Christ Church Cathedral, February 1.

Dr. A. B. Stout, of the New York Botanical Garden, showed colored

ONCIDIUM PANAMENSE

movies of the New York Garden to the staff and students of the Missouri Botanical Garden, at the Museum Building, January 15.

The January and February numbers of *Flower Grower* contain illustrations borrowed from the Garden BULLETIN, the one in the January number showing the method of forcing bulbs, and in February, specimens of house plants.

Mr. Ladislaus Cutak, in charge of Succulents at the Garden, has published the following papers recently: "Florida Adventure," in the December 1941 number of *Journal Cactus & Succulent Society of America* (**13**:203-206); and "Down in Seminole Land," in the January number of *Gardeners' Chronicle of America* (**46**:14-46).

The February number of the ANNALS OF THE MISSOURI BOTANICAL GARDEN has been issued, with the following contents: "Contributions to Our Knowledge of Carboniferous Plants. I. Scleropteris, gen. nov., Mesoxylon and Amyelon," by Henry N. Andrews; "II. Lepidocarpon," by Henry N. Andrews and Eloise Pannell; and "New Gesneriaceae from Panama," by C. V. Morton.

Dr. Edgar Anderson, Geneticist to the Garden, has given the following talks recently: "Indian Corn," before the High School Science Clubs, at Washington University, January 13; "Vegetable Gardening in St. Louis," before the Ladue Garden Club, February 3; "Corn of the Southwestern Indians," before the Anderson Chapter of the St. Louis Junior Academy of Science, Southwest High School, February 5.

Recent visitors to the Garden include the following: Dr. John Hendley Barnhart, Bibliographer, New York Botanical Garden, Bronx Park, N. Y.; Dr. G. W. Beadle, Professor of Genetics, Stanford University, Calif.; Dr. A. F. Blakeslee, of the Carnegie Institution, Cold Spring Harbor, Long Island, N. Y.; Dr. Ray J. Davis, Professor of Botany, University of Idaho, Southern Branch, Pocatello; Dr. Norman C. Fassett, Assistant Professor of Botany, University of Wisconsin, Madison; Dr. Harry J. Fuller, Associate Professor of Botany, University of Illinois, Urbana; Dr. George B. Happ, Assistant Professor of Biology, Principia College, Elsah, Ill.; Dr. Mary Maxine Larisey, Assistant Professor of Biology, Judson College, Marion, Ala.; Dr. R. E. Marker, Associate Professor of Chemistry, Pennsylvania State College; Dr. Norma E. Pfeiffer, Research Morphologist, Boyce Thompson Institute for Plant Research, Yonkers, N. Y.; Dr. E. R. Spencer, Professor of Botany, McKendree College, Lebanon, Ill.; Dr. Charles Thom, Mycologist, Bureau of Plant Industry, U. S. Dept. Agr., Washington, D. C.; Mr. John C. Wister, Director of the Arthur Hoyt Scott Foundation, Swarthmore College, Swarthmore, Pa.

STATISTICAL INFORMATION FOR JANUARY, 1942

GARDEN ATTENDANCE:	
Total number of visitors	13,526
PLANT ACCESSIONS:	
Total number of plants, seed packets, and bulbs received as gifts	265
LIBRARY ACCESSIONS:	
Total number of books and pamphlets bought	29
Total number of books and pamphlets donated	457
HERBARIUM ACCESSIONS:	
By Purchase—	
Avenue Camera Store—Photographs of type specimens	9
Brenckle, J. F.—Fungi of Dakota	650
Cronquist, Arthur—Plants of Idaho	900
Degener, Otto—Plants of Hawaii	162
Gentry, Howard Scott—Plants of Mexico	450
By Gift—	
Darker, G. D.—Fungi of Ontario, Massachusetts and Missouri	18
Demoise, C. W.—Lichens of Pennsylvania and Maryland	25
Field Museum of Natural History—Plants of Guatemala	77
Fox, Lauretta E.—Plants of Louisiana	47
Greenman, J. M.—Photograph of type specimen of *Hymenoxis quinquesquamatum*	1
James, Leslie—Plant of Alabama	1
Lutrell, E. S.—Lichens of Virginia	778
Meyer, Fred—Plants of Horticulture	2
Ownbey, Gerald B.—*Fomes igniarius* (L.) Fries from Wyoming	1
Pfeiffer, Norma E.—Plants of Illinois	4
Thomas, John W. Jr.—Lichens of the United States and Mexico	22
Welch, Walter B.—Plants of Illinois	374
West, Erdman—Plants of Florida	6
By Exchange—	
Beetle, A. A.—Plants of California	100
Field Museum of Natural History—*Pittosporum kauaiense* Hillebr. from Hawaii, and plants of Panama	10
Martin, G. W.—Miscellaneous Fungi	43
Stratton, Robert—Plants of Oklahoma	256
Tolstead, W. L.—Plants of Nebraska	532
University of Washington, Seattle, by C. L. Hitchcock— Plants of British Columbia	159
By Transfer—	
Berry, E. C.—Plants of Horticulture	3
Cutak, L.—Plants of Horticulture and plant illustrations	4
Total	4,634

STAFF
OF THE MISSOURI BOTANICAL GARDEN

THE GARDEN, 2315 TOWER GROVE AVENUE, ST. LOUIS, MISSOURI

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Engineer

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Orchid Grower

REPRESENTATIVE IN THE TROPICS

PAUL H. ALLEN,
Balboa, Canal Zone

REPRESENTATIVE IN EUROPE

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by

Julian A. Steyermark

"A book that is complete. . . . Undoubtedly the book Missouri flower-lovers have been looking for."

Missouri Historical Review

". . . In short, the *Spring Flora of Missouri* is the best 'Spring Flora' available at present in the United States."

American Midland Naturalist

"Should be of great use to local garden clubs, and for the scientific worker who is concerned with the local flora it should be invaluable."

National Horticultural Magazine

"Carefully and critically done, so that it should find wide and enthusiastic reception at the hands of all who enjoy being acquainted with the rich native flora of Missouri."

Rhodora

"The most comprehensive spring flora ever issued for any state. . . . Notable for presenting its data in simple non-technical English, yet with thorough scientific accuracy. Book's value not limited to Missouri."

Field Museum Notes

For sale by the Missouri Botanical Garden. Price $3.00

MISSOURI BOTANICAL GARDEN BULLETIN

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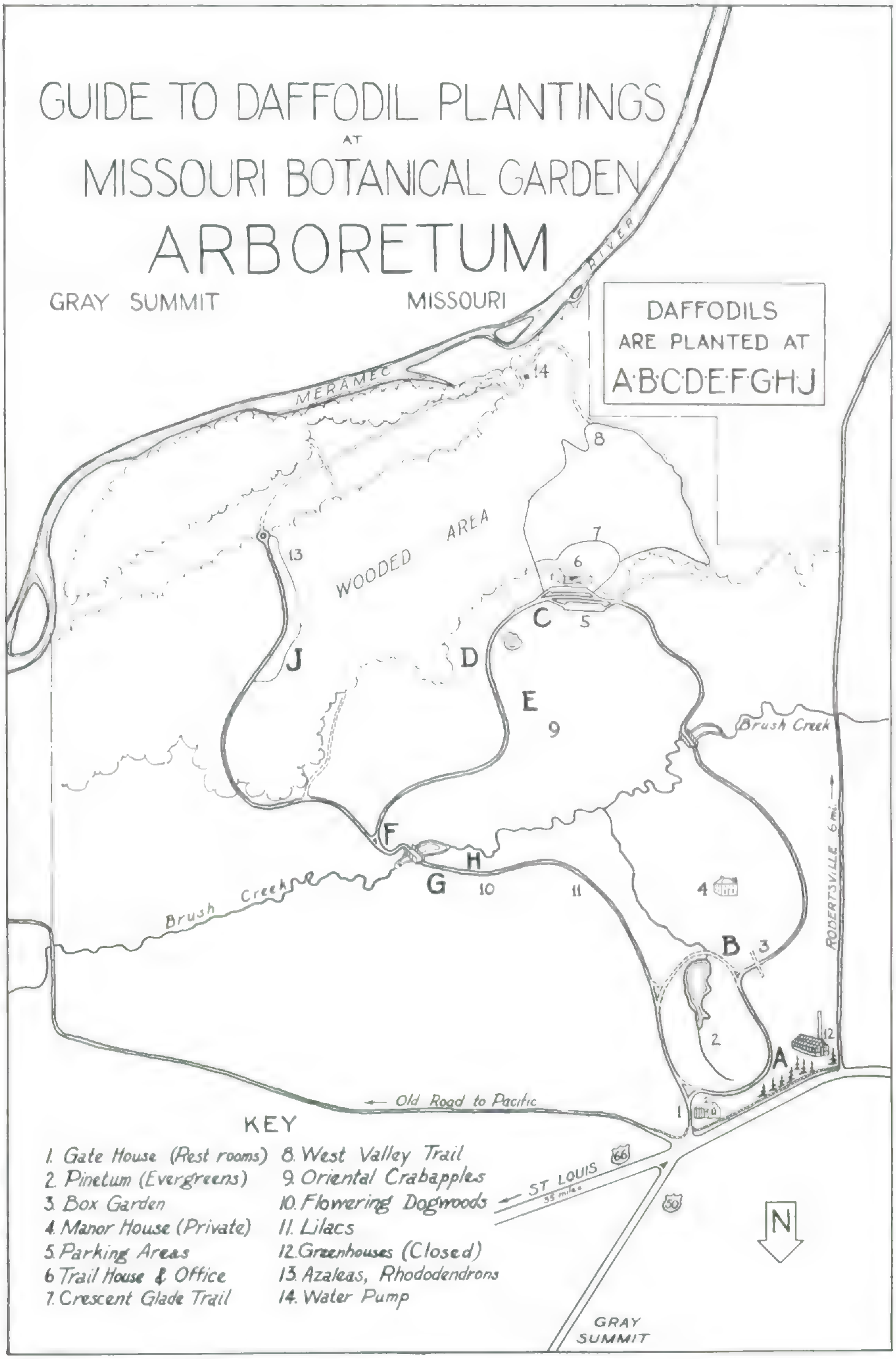
SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date until his death in 1889 it was maintained under his personal direction. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was chosen by Mr. Shaw and he definitely indicated that he wished it called by that name. The Garden passed at his death into the hands of a Board of Trustees, designated in Mr. Shaw's will, and the Board so constituted, exclusive of certain ex-officio members, is self perpetuating. By a further provision of the will the immediate direction of the Garden is vested in a Director, appointed by the Board. The Garden receives no support from city or state but is maintained almost exclusively from the estate left by Henry Shaw. Since 1939 many Garden Clubs and interested individuals have contributed to a "Friends of the Garden Fund" which is used in developing the new Arboretum, located at Gray Summit, Mo. The Arboretum (1) serves as a source of plants, trees and shrubs for the city Garden; (2) affords areas for gradually establishing a pinetum, a wild-flower reservation and various other features on a scale not possible in the city; (3) provides greenhouses for some 20,000 orchid plants.

The city Garden comprises 75 acres, where about 12,000 species of plants are grown, both out of doors and under glass. It is open every day in the year except New Year's Day and Christmas; week days, 8:00 a. m. until sunset; Sundays, 10:00 a. m. until sunset. The greenhouses are closed every day at 5:00 p. m.

The main entrance to the Garden is at Tower Grove Avenue and Flora Place, on the Sarah car line (No. 42). The Tower Grove bus (No. 21), direct from downtown, passes within three blocks of the main entrance.

GUIDE TO DAFFODIL PLANTINGS
AT
MISSOURI BOTANICAL GARDEN
ARBORETUM
GRAY SUMMIT MISSOURI



KEY

1. Gate House (Rest rooms)
2. Pinetum (Evergreens)
3. Box Garden
4. Manor House (Private)
5. Parking Areas
6. Trail House & Office
7. Crescent Glade Trail
8. West Valley Trail
9. Oriental Crabapples
10. Flowering Dogwoods
11. Lilacs
12. Greenhouses (Closed)
13. Azaleas, Rhododendrons
14. Water Pump

Missouri Botanical Garden Bulletin

Vol. XXX MARCH, 1942 No. 3

NARCISSI AT THE MISSOURI BOTANICAL GARDEN

From early March to the first week in May the narcissus collections at the Missouri Botanical Garden Arboretum at Gray Summit provide a continuous mass display. It is a two-month pageant which begins with the brilliant yellow trumpets of FEBRUARY GOLD and ends with the clear white blooms of the old-fashioned variety RECURVUS. If the season is early, flowering may begin in February, or in a very late spring not begin until the middle of March, but it always reaches its peak some time in April.

The Arboretum displays are of two kinds: mass plantings of a few varieties for landscape effect; and smaller plantings of individual varieties for comparison and study as well as for display. The accompanying map shows the approximate location of these various plantations. It will be seen that these are mainly at three points: 1) In the pinetum (A & B on the map) a few varieties, SIR WATKIN, EMPEROR, GLORY OF LISSE, BIFLORUS and RECURVUS, have been planted by the tens of thousands; 2) in the center of the Arboretum (at C, D, & E), conveniently located to the parking lots, is the main variety collection though a few plantings of individual varieties have been made at other points (F, G, H); 3) in the "Daffodil Valley" (J on the map, and open to the public only by special arrangement) is a mixed plantation of about 20 kinds established some years ago and a small collection of choice varieties which for one reason or another have not yet been moved to the main group near the parking fields. Since the hills at this latter point form a natural amphitheater the display can be enjoyed from the road and the visitor will be able to see everything except the display in the Daffodil Valley without leaving his car. The variety collection has all been planted in the last two years and will need at least another five years before it really shows to advantage, but the display in the pinetum has already reached the point where it provides masses of fresh clear bloom in the spring landscape.

The narcissi at the Arboretum, however, are more than just a display. They are a real variety test-garden, carefully assembled and accurately recorded; made to discover and then to demonstrate just which varieties

are best for naturalizing in this region. While it might be supposed that this information is already in the books we have found to our sorrow that it is not. Narcissi can be used in many ways: as specimen plants; as accents for the perennial border; or in great semi-naturalistic masses as we are attempting to do. For that purpose some of them are excellent and some are mediocre and a considerable number are unsatisfactory. The daffodil expert, however, usually becomes so fascinated with these flowers that he is not content to grow them in this fashion but has a special garden in which they are carefully cultivated and brought to perfection. He usually wants super-narcissi and is willing to pay any price in money or effort to get them. He is seldom interested in finding out which varieties have the hardiness to provide for themselves and to give a satisfactory performance in a grass meadow or an open woodland. We therefore have the paradox that although of all bulbs they are the most satisfactory for naturalizing there is little or no *exact* information on the subject. The collections at the Arboretum have been planned to supply that deficiency. By reading, correspondence and observation we have selected a group of promising varieties. Accurate records are made of the number of bulbs planted, and each spring, in so far as time permits, records are made of the number of blooms obtained. Though this has been carried on only for five years and though it began in a very small way, valuable information has been obtained. We shall be interested in hearing from any readers who have other varieties to suggest, particularly if they can provide us with enough bulbs to make a trial planting.

One of the reasons exact information about the behavior of naturalized bulbs is so hard to obtain is the difficulty of keeping such a collection labelled. Several of our best varieties are unnamed because they came to us from other gardeners who had lost the labels or who had themselves received them in that condition. If one is growing narcissi in a grassy meadow it is next to impossible to label them in any ordinary way, since the labels interfere with the mowing and are easily lost and hard to locate. Mapping is fairly easy if there are only a few varieties but becomes difficult or impossible when a large number of varieties are grown. What appears to be a way out is to plant bulbs near permanent trees to which labels may be attached. In the meadow where the largest collection is located there are a number of volunteer red cedars which require only the aid of an occasional mowing to develop into specimen trees (mowing protects such cedars because it keeps out the broad-leaved trees which would otherwise shade and eventually kill them). On the opposite slope from the cedars there are well-established specimens of various oriental crabapples. The cedars and crabapples are used as markers for the narcissi; each variety is planted near a tree, its label placed near the base of the tree where it is out of the way of the mowing

machine, yet relatively easy to locate. This system seems to be working well at present but only time can tell if it will be permanently effective.

To naturalize well, a variety must have certain outstanding qualities, and since it is to be used in quantity its price is particularly important. If two varieties have practically the same landscape effect and one is much cheaper, then it is certainly the one to recommend for planting by the thousands. However, if an outstanding but expensive variety, like BEERSHEBA, is in every way excellent for naturalizing then one may be justified in buying a few bulbs and taking special care of them so that they reproduce rapidly. The most important quality in narcissi to be naturalized is the ability to grow well in competition with other plants, particularly grass. The next essential is a stout stiff stem which will withstand wind and snow. Many of the most beautiful show narcissi fail in this regard since the flowers are much too large for the slender stems and fall down in the first bad storm. Another quality of great importance is the substance of the petals and the length of bloom. BEERSHEBA and FEBRUARY GOLD can stay in bloom for two weeks if the weather is cold and they can survive sleet or snow and still look attractive. Large flowers are excellent if combined with stout stems, but many of the biggest daffodils now on the market have two disadvantages. Some of them do not retain their size when they are planted in grass, and they are therefore not superior to the cheaper old-fashioned varieties, such as EMPEROR, which is nearly as large when flowered in a meadow as in a carefully tended garden. Secondly, unless they wither rapidly their inordinately large petals may be an actual drawback after they have flowered. There are a number of such varieties which are positively unsightly for five days to a week after they are out of bloom and, of course, in a large collection one cannot spare the time to pick off blooms individually after they have passed their prime.

The following varieties are now being grown at Gray Summit. In writing the descriptions the perianth segments are referred to as "petals" since that is what they look like to the average person. Several different terms have been used in discussing the corona; it is sometimes referred to as the "trumpet", sometimes as the crown or cup, depending somewhat upon its size in the variety under discussion.

ACE OF DIAMONDS: A large clear-white Poets narcissus with a bright red eye. By many experts it is rated as one of the very best of its class. It does not differ greatly from FIRETAIL. As compared with that variety its petals are a little larger and are proportionately broader towards the tip. The stem is shorter, giving its flowers the appearance of being a little more down among the foliage, but its landscape effect is very similar. (C)[1]

[1] The capital letters refer to the accompanying map and indicate where the variety is planted.

AEROLITE: A large daffodil with broad primrose-yellow petals and a rich yellow trumpet. Of the modern large trumpet daffodils this is one of the few which are worth trying out in naturalistic plantings. It stays in flower longer than any trumpet daffodil on which we have kept records and stood up well in the late freeze in 1940. (F)

BATHS FLAME: (Often called FLAME). This variety has been extensively recommended for naturalizing. The flat light yellow flower has a short cup of darker yellow edged with orange-scarlet. (E)

BEACON: A small-flowered BARRI. (C)

NARCISSUS AEROLITI

BEERSHEBA: One of the most outstanding daffodils for any purpose. The flowers are large with flat white petals and a long trumpet of a clear pure white. Grown in grass, they maintain their size but are short-stemmed. They stay in flower for a very long period and have weathered sleet and heavy snow without protection. Six bulbs acquired in the summer of 1938 produced 7 flowers the next year, 9 in 1940, and 10 in 1941, though planted in grass and given no special care. (C)

BERYL: Because of our interest in species crosses we were given a bulb by the originator, Mr. P. D. Williams, in 1931. We have grown it ever since, moving it first to Massachusetts then back to St. Louis and eventually to Gray Summit. Though a few bulbs were given away and though in moving it was not always possible to dig it up at the best time of year, we had 14 bulbs by 1938 and 21 bulbs by 1940. Those who grow only a single bulb of this variety, or who see only a single flower at a show, may under-

stand why Mr. Williams was once on the point of throwing away what has since become one of the most outstanding narcissi for those who have rock gardens or who take a special interest in small flowers. BERYL is a first-generation hybrid between a Poets narcissus and the curious dwarf *Narcissus cyclamineus*. The hybrid is almost as elfin as the latter species but is very much easier to grow. The flowers are about 1½ inches across and are borne on 4- to 6-inch stems. They have a bright orange cup and waxy petals which turn back farther and farther the longer they stay open. When they first open they are a soft butter-yellow but they fade to an almost ivory-

NARCISSUS FIRETAIL

white. A large group of them is particularly attractive for this reason, the freshly opened flowers making deeper accents against the background of the mass. (J)

BIFLORUS: Any one who has travelled in Tennessee and Mississippi in early May will remember this old variety which grows in masses about many old southern mansions and often persists long after the house is in ruins. The flowers are something like those of the Poets narcissus but are smaller and are borne in two's, as the name implies. Although very old and cheap they are excellent for naturalizing in grass. Since they are seldom seen much farther north it is possible that St. Louis is about the northern limit for their effective cultivation. (A, B, D)

BRILLIANCY: Similar to BATHS FLAME in landscape effect, but preliminary results indicate that it is inferior to it for naturalizing. The flowers are too large for the stem and are injured in snow or sleet storms. (G)

BUTTERCUP: A hybrid with the true jonquil. Bright yellow with a very long blooming season. It has done very well in the St. Louis Garden; how it will stand up in competition we do not yet know. (E)

CERVANTES: We know nothing about this variety except that it is cheap. Since we have had great difficulty in naming old-fashioned narcissi which are excellent for naturalizing, we bought a few of this variety with the hope that it might be one of our unknowns. (E)

CHICOPEE: A *cyclamineus* hybrid presented by the originator, Mr. Edwin C. Powell. (J)

CIRCLET: A large flat flower of very pale yellow with a yellow-orange cup. (C)

DANTE: Bought for the same reason as CERVANTES. (C)

EMPEROR: In our opinion, one of the best bulbs for naturalizing. Large-enough flowered to make an excellent display but not too large to seem unsightly when withering. A trumpet daffodil of a soft shade of primrose-yellow which is particularly attractive in masses. Fifty bulbs set out in the fall of 1938 were producing 186 flowers in their third season of bloom, while the same number of bulbs of the more expensive KING ALFRED planted at the same time were only producing 87 flowers. (A, J, G, E)

EMPRESS: Similar to EMPEROR but with white petals. Also excellent for naturalizing. If our results are typical it prefers more shade than EMPEROR. (J, G)

FEBRUARY GOLD: This variety is a hybrid with *Narcissus cyclamineus* but it shows only slight indications of the influence of that species. It is a brilliant deep golden yellow and its petals curve back in a jaunty fashion. It has remarkable substance and can go through a freeze so severe that the flower is stiff, yet when it thaws out it will still be attractive and apparently uninjured. While at the Arboretum it seldom justifies its name by blooming in February, it is always one of the earliest, if not the earliest, variety to bloom in our collection, rivaling the old-fashioned small yellow trumpet narcissi. It increases rapidly and does well in grass. Three bulbs planted in the fall of 1938 gave 6 flowers in the next season and 9 two years later. (A, E, J)

FIGARO: This is an old-fashioned yellow LEEDSI which has given a fairly acceptable performance with us. It is early season for a LEEDSI and has a small flower on a tall stem. The petals are slightly twisted and the cup is a slightly deeper color along its margin. (J)

FIRETAIL: See remarks under ACE OF DIAMONDS. (C)

GALOPIN: A white flower with a red cup which we are trying for the first time this year. (J)

GERTIE MILLAR: A large, very light-colored trumpet narcissus. It has

done very well in the city Garden and we are now trying it out at the Arboretum. The perianth is pure white, the trumpet a very pale yellow and strongly fluted. (C)

GLORIA MUNDI: We are planting this variety because it has proved so satisfactory for Mr. John Howe, of Pacific, Missouri. It is a mid-season variety with a small to medium cup. The perianth is light yellow, somewhat fluted and folded, and the cup or crown has fine flutings of red which blur on the yellow background to give an impression of deep orange. It is strong-stalked and floriferous. (C)

GLORY OF LISSE: An early-flowered Poets narcissus, valuable because it naturalizes well and because it flowers at the same time as the medium-length yellow trumpets. The flower is of medium size, the petals wavy but not incurved. The cup is greenish-yellow with a narrow border of red. (A, C)

GOLDENSPUR: A fine-looking bright yellow trumpet which has barely held its own when planted in the grass. (C)

HERA: A small-flowered, light-colored LEEDSI which is being tried out for the first time this year. (E)

HOMESPUN: A pale yellow medium trumpet. (J)

HORACE: A Poets narcissus which has been frequently recommended for naturalizing. We are growing it this year for the first time. (C)

ICICLE: White-flowered and mid-season. (J)

KING ALFRED: A large almost greenish-yellow trumpet excellent for forcing and dependable in the garden but not recommended for naturalizing. See remarks under EMPEROR. When grown in grass it does not maintain its size and is only a little larger than EMPEROR. (A, E, H, J)

LARGE BICOLOR: This is a comparatively modern veriety which was given us by Mrs. J. Norman Henry because it had proved so satisfactory in her garden. Unfortunately, it came to her minus any label and we have not yet been able to identify it. (C)

LAURENS KOSTER: Another variety common in the South which is apparently reliably hardy in St. Louis. It is a Poetaz narcissus with several flowers on a stem and has small white flowers with orange-yellow cups. We are using it to give masses of color in the background of our variety plantations. (D, J)

LONG-STEMMED LEEDSI: We have not yet been able to identify this old-fashioned variety which we obtained from Mr. John Howe, but it is one of the best for naturalizing in grass. The flowers are not large but they are well formed and are borne on stout stems. It increases rapidly but does not require frequent replanting. (C)

LUCIFER: This variety has done well in the city and we are now trying

it out at the Arboretum. It has a starry white perianth and an orange-red cup. It has a stout stem and a long blooming period. (F)

MARCH SUNSHINE: Like FEBRUARY GOLD, this is a hybrid with *Narcissus cyclamineus*, but if our experience is typical it is not to be recommended for naturalizing. It has a short blooming period and does not increase rapidly when planted in the grass. (C)

MASTERPIECE: A flat creamy-white flower with an orange cup. Too floppy for the wild garden. (H)

MISS WILLMOTT: A wide-spreading flower with a jagged and irregular crown. It apparently has a stem stout enough to hold the large flower. (C)

MITYLENE: A large pale-colored flower which has been much admired as a garden or exhibition variety. It does not stand up well outdoors. (J)

MRS. LANGTRY: A very old-fashioned LEEDSI which naturalizes well. (J)

MRS. R. O. BACKHOUSE: Many people feel that this variety has the loveliest color combination of any narcissus. When the flower first opens the trumpet is a sort of pale orange-pink, the depth of color depending somewhat upon the season. As it fades, the yellow leaves first and then the pink, so that by the time the flower is through blooming it is cocoa-pink or almost ecru. When this variety becomes cheap enough to plant in large masses, the resultant play of color should be very attractive. The flower is of medium size and stands up well under natural conditions. The one bulb which we planted in 1937 has increased to two large double-nose bulbs and one offset. (J)

OBVALLARIS or TENBY DAFFODIL: This old variety has been very much admired by connoisseurs. It is a small to medium-sized trumpet daffodil with a short trumpet and broad round petals. (C)

OLD-FASHIONED YELLOW TRUMPET: The sturdy small-flowered variety that begins the season in many old Missouri gardens. While it is not as effective in the landscape as FEBRUARY GOLD, which blooms at the same time, it is very reliable and very cheap. (J)

ORANGE CUP: A dull yellow Poets variety which looks almost brown in the distance. It is apparently not quite hardy in St. Louis. (J)

PRINCEPS: An early light yellow trumpet. It is old and cheap and we have used it for mass effects. (D)

RECURVUS: One of the oldest varieties of Poets narcissus but still one of the best. It is the latest variety in our collection and sometimes is in flower the last of May. It has smallish flowers of clear white set at the top of tall stout stems. The cup is greenish-yellow with a distinct edge of dark red. The petals are somewhat reflexed, as the name implies, and they have wavy inrolled margins, undesirable in a show flower but giving a light and airy effect when growing in the grass. (A, B, C, J)

RED BEACON: A BARRI narcissus, the petals shading to soft yellow at the base, the fluted cup a brilliant orange-red. (C)

SEAGULL: A medium to small-flowered LEEDSI with a light lemon-yellow cup, very slightly darker along the edge. It has increased rapidly at the Arboretum and now makes an attractive display near the east bridge. Compared to the better-known variety WHITE LADY, it is smaller, later, and has a smaller, less-flaring cup. (H)

SIR WATKIN: The old reliable variety among the medium-crowned daffodils. It takes unusually well to Missouri conditions and gives as good a display in bad seasons as in good ones. (A, B, C, J)

STELLA: An old-fashioned white LEEDSI which has the ability to hold its own when naturalized. Petals white, slightly fluted; cup fairly large for the size of the flower, pale lemon-yellow. (J)

TEXAS: An extremely large double-flowered narcissus. Blights badly in cold weather. Not recommended for St. Louis. (J)

TORCH: Too floppy for naturalizing in Missouri. Short blooming period. (G)

TREWIRIGIE: Like BERYL, this is the gift of the originator, Mr. P. D. Williams. It was produced by crossing BERYL with a yellow trumpet daffodil. The stem is short and the flower small but the variety has its merits. Though a little too coarse for use in rock gardens, it has a certain pleasing balance. It stays in flower a very long time and is very attractive in a clump. The leaves are somewhat malformed. (D)

TRIANDRUS HYBRIDS: Mr. Williams also gave us two of his precious hybrids with the "Angels-Tears" narcissi, and while they have since been named and introduced we have not been able to make accurate comparisons and still grow them as "White Triandrus Hybrid" and "Yellow Triandrus Hybrid". They are doing very well for us and we now have 15 or 20 bulbs of each. One is pure white, the other has a yellow cup with white petals and both have dainty, slightly drooping flowers. (C)

TRUMPET MAJOR: An old-fashioned yellow trumpet which we have used for background plantings. (A, J)

TULLUS HOSTILIUS: A jonquil hybrid which has done well in the city Garden and which we are now trying out at the Arboretum. (E)

VON SION: The old-fashioned double yellow trumpet which has been common in America since it was first grown in colonial gardens. You may think you do not care for double flowers but if you are making a large planting of daffodils you will find this old variety useful. Planted in the background it will give a good note of color (a rather greenish-yellow) and it stays in flower at least a week longer than the single trumpets. It also

has excellent keeping qualities as a cut flower and combines well with other kinds of flowers. (J, H)

VICTORIA: Similar to EMPRESS. We have a few bulbs which have held their own under very adverse conditions. (J)

WHITE LADY: See remarks under SEAGULL. While we have not had this variety in our collection long enough to speak from personal experience, it has been very much recommended as a variety for planting in the grass. (D)

WILLIAM GOLDRING: A small greenish-white trumpet daffodil with narrow petals. It does not increase rapidly but its size and shape make it a most appropriate variety for naturalizing. (J)

WILL SCARLETT: An outstanding variety with creamy-white petals and a fiery orange-red cup of considerable size. The color carries well at a distance. We have had it only one year and cannot yet report on its behavior when naturalized. (E)

YELLOW POPPY: Tried out for the first time this year. (E)

In addition to the above varieties the Garden has a considerable collection of narcissi at the main garden in St. Louis. This year some of these have been grouped together for comparison in the so-called "Spring Garden," between the Floral Display House and the Linnean Garden. The following varieties are included:

Ace of Diamonds
Aerolite
Alasnam
Alcibiades
Arthur Bowman
Beacon
Beersheba
Biflorus
Bohemienne
Dawson City
Diana Kasner
Dosoris
Emperor
Fairy Queen
Firetail
Frau Margarethe Hohmann
Gainsborough
Gertie Millar
Laurens Koster
Micareme
Nursemaid
Pearly Queen
Silver Star
Stella Pratt
Sunrise
Sylvanite
Tampa
Tullus Hostilius
Twink

The following varieties are planted at various places in the Knolls:

Alcida
Bernardino
Buttercup
Croesus
Golden Sceptre
Helios
Horace
King Arthur
Lady Moore
La Vestale
Lord Kitchener
Lovenest
Mrs. E. H. Krelage
Mrs. Nette O'Melveny
Sir Watkin

There is also a planting of about 20 varieties in the Mausoleum grounds. It was made some twenty years ago with such narcissi as LUCIFER, BERNARDINO, HELIOS, and SUNRISE. It is at present unlabelled though another season will probably see the more unusual varieties added to the other collections. A few varieties of narcissi, principally SIR WATKIN, have been planted in large masses at various points throughout the Garden and along Magnolia Avenue.

E. A.

THE MISSOURI BOTANICAL GARDEN ARBORETUM, A LABORATORY FOR THE WEEK-END GARDENER

Reprinted from BULLETIN OF THE GARDEN CLUB OF AMERICA, *January, 1942*

The Missouri Botanical Garden acquired a typical American horticultural problem when, like many private gardeners, it bought a tract way out in the country and started the development of an Arboretum. I do not know what percentage of American gardeners have bought such a place in the last 20 years but it has been done very frequently. Sometimes it has begun as a hunting or fishing camp, sometimes as a wild-flower reservation, but always as a means of getting away from the city over Saturday and Sunday or for a short vacation in the spring and summer. While each of these country places has its own individual problems, they all have much in common and the phrase "weekend gardening" has become nationally significant. Such gardening has its joys but it also has its own peculiar difficulties, and our Arboretum in the edge of the Ozarks is already becoming a laboratory where many of the special problems of such accessory gardens can be studied.

The word "accessory" has been used advisedly. We have not moved the city garden out bag and baggage but have acquired somewhat over 1,000 acres at Gray Summit to carry on a number of horticultural activities which are difficult or impossible in the city. We raise our orchids there in the clearer country air and have started a pinetum away from the adverse conditions of the city. Several hundred acres have been set aside for a wild-flower reservation and in the springtime there are big mass displays of narcissi and oriental flowering crabapples.

Like most such accessory gardens, the Arboretum presents a number of peculiar problems. Since it is accessory it cannot be given the time, the attention, or the money which goes into the main garden in the city. The area is so large that artificial watering, except for newly transplanted material, is quite out of the question. The fire hazard is great at many times of the year. Visitors from the city feel that they are out in the country and they take liberties which would never occur to them inside the

city limits; they may gather armfuls of choice narcissi or even come in over the fence and use our cordwood to make a campfire on the back part of the property. Worst of all, they may even depart without putting out the fire.

We have not yet solved all of these problems; perhaps some of them can never be solved; but we have by trial and error worked out a basic design which reduces them to the minimum. Recognizing the fact that our visitors travel mainly by automobile, we have designed a circular drive of approximately two miles which is operated as a one-way circuit so that visitors enter and leave by the same gate. The main features of the Arboretum, the crab-apple collection, the narcissi, the wild-flower garden and the pinetum, are along this circuit and most of them are arranged so that the average visitor may enjoy them without having to leave his car. For most of the way a natural tangle of shrubs, vines and wild flowers is being encouraged along a rail fence which lines the road on both sides. Behind the fence is partly woodland and partly semi-natural meadows dotted with red cedars. These cedars are native to the area and they come up abundantly in every deserted pasture and abandoned field. Under natural conditions they soon disappear because they are intolerant of shading and die out when other trees come up around them. By mowing once a year it is possible to keep down the other trees and let the cedars dominate the meadows. They are already beautiful, particularly during the winter months when they stand out in contrast to the bare woodlands; in another decade when they have grown into something like mature trees they should really be impressive.

The maintenance of such meadows presents one problem which is so general that it may be touched on here, the control of *Andropogon virginicus*. I use the botanical name from necessity and not from preference; although it is a serious pest in many of our eastern states, no common name for this obnoxious grass has yet come into general use. Some books list it as "Broom Sedge" or "Old Field Beard Grass"; who ever heard a genuine farmer discussing the "old field beard grass" in his cow pasture? It is, at any rate, a coarse grass which grows in large clumps and which remains semi-dormant until after mid-summer when it shoots up in stiff reed-like masses three to four feet high and tassels out with feathery little white hairs in the early autumn. When the frost strikes it, it colors rather brilliantly and then fades into a tawny brown-red and remains one of the dominant color notes in our winter landscapes. In addition to its aggressiveness it has two very bad features. During most of the year it is unpalatable to live-stock and it is therefore a serious weed in many pastures. Worst of all it is one of the oil-grasses and is a serious fire-hazard in any area where it grows abundantly. It is so full of oil that one of its winter plumes can be ignited with a match even immediately after a soaking rain. It is so oily that it burns with a hot

GLIMPSE OF THE GLADE TRAIL AT THE GARDEN ARBORETUM

flame, and a grass fire which can be easily stamped out becomes uncontrollable when it runs into a thick patch of andropogon. Once this grass appears in an abandoned meadow it causes a vicious cycle of deterioration. The meadow ignites more readily, it burns with a hotter fire, and kills out competing vegetation so that after the fire the andropogon comes in stronger than ever and is therefore a worse fire hazard than it was before, catching fire more readily and encouraging the development of still more andropogon. Such a cycle may continue until the field is practically a pure stand of andropogon. Our preliminary tests have shown that it can be discouraged by the proper sequence of treatments and a comprehensive series of experiments is now under way. We already know that it is very much discouraged by late summer mowing. In two or three more years we shall be able to make even more definite recommendations.

The development of our wild-flower garden we are finding particularly interesting because it is so difficult. In the states along the Atlantic seaboard with their abundant water supply and with at least two centuries of garden experience, it is comparatively easy to produce an acceptable wild-flower garden if one has a decent site and a little patience. In our Missouri climate any one who attempts to follow the simple eastern pattern is doomed to failure. He may plant white trillium by the hundred but it flowers for only a season or two at the most. He may purchase by the carload the shrubs and wild flowers which come on so reliably in the East; in our hot summers they either die altogether or struggle along in a death-in-life which is far from attractive. Any one who makes a wild-flower garden in Missouri is a pioneer and, like all successful pioneers, he must be able to learn something from his mistakes.

Though we began by introducing (or rather by attempting to introduce) wild flowers from elsewhere we have now settled down to the much sterner discipline of encouraging the wild flowers which are already with us. We no longer go about with an axe cutting out the underbrush and opening up pleasant vistas. We have learned that every time we cut out a shrub or prune off a big limb we upset the balance of light and shade which had been established at that point. For every weedy little shrub which is set out, five others will spring into the hole which is left by its removal; no spot in our wild-flower reservation is more choked with horrid weedy growth than those which were "improved" five to ten years ago.

This does not mean, however, that we patiently fold our hands and let nature take its course. Far from it. We try instead to figure out what nature is attempting to do in each particular spot and work with her rather than against her. Instead of pruning out the undergrowth where it is too thick we wait for it to be thinned by natural causes. Then as soon as a tree

or a branch dies we throw it on the ground where it would eventually have fallen anyway; all we have done is to speed up the process. In felling it, however, we are careful to make it lie *across* the slope. In doing so it holds the fallen leaves and keeps them from washing down the hill, it retards erosion in every rain, lessening the danger on the slopes below and holding back the moisture to benefit the wild flowers near by. We do not always get the effects we wish but when occasionally we do press the right button the results are amazing, as, for example, the time when we spent a few hours pushing over the dead stubs on a dry hillside late one summer and trapped enough extra moisture so that the violets thickened into bright drifts of purple behind each of the logs by the following spring. Each of the plants native to our garden has its own likes and dislikes and as we learn their individualities we are able to work with them successfully. Redbud does not like shade and can be encouraged around the borders of the woodlands and along the fire trails. The Celandine poppy (*Stylophorum diphyllum*) prefers neither the hillsides nor the valleys but the slopes where they join and if planted there it increases rapidly. River gravels introduce an alien habitat along with alien seeds and if we use them for paths we have ugly weeds to fight, but the stony mixture from the dry creeks in the wild garden has just enough clay to tread into a hard surface and to produce a soil which blends naturally with that already on the site.

The Arboretum therefore is more than just another garden for display. It is a laboratory where we are finding out how to work efficiently and effectively with the American landscape. The bluegrass meadows studded with red cedars, the winding roadways lined with rail fences, the limestone glades with their own peculiar wild flowers are easy to protect and economical to maintain. Even on a small budget they can be encouraged to grow into a beautiful and harmonious landscape. E. A.

NOTES

Dr. Edgar Anderson, Geneticist to the Garden, spoke before the Biological Fraternity of Harris Teachers' College, February 17, on "Kinds of Corn."

The biology classes of Principia College, Elsah, Illinois, visited the Garden library and greenhouses in two groups, one on February 23 and one on February 24.

Mr. A. P. Beilmann, Manager of the Garden Arboretum, gave an illustrated talk on "Flowers of Native Trees" before the Men's Club, at Gray Summit, February 13.

The February number of *Modern Cemetery* (**51**:165-166) has reprinted the article "Don't Burn the Leaves" from the Garden BULLETIN, under the title "Utilizing the Leaves as Fertilizer."

The March number of *Chronica Botanica* (**7**:*77-79*) contains a paper by Mr. Robert W. Schery, Graduate Assistant in the Shaw School of Botany, on "A Few Facts concerning the Flora of Panama."

Mr. William L. Brown, Cytogeneticist, U. S. Golf Association, Green Section, Washington, D. C., formerly Research Fellow Shaw School of Botany of Washington University, spent a week at the Garden recently.

Dr. David C. Fairburn, Horticulturist to the Garden, spoke before the Beta Sigma Phi Sorority, at the Hotel Coronado, January 2, on "Color, Form and Fragrance of Gardens"; and before the Clifton Heights Garden Club, March 18, on "Seed Planting and Propagation."

Professor Walter B. Welch, with his biology class from the Southern Illinois State Normal University, Carbondale, visited the Garden on February 17 and inspected the orchid-seedling work under the direction of Dr. David C. Fairburn, Horticulturist to the Garden.

"A Florida Adventure", a paper by Mr. Ladislaus Cutak, in charge of Succulents at the Garden, which appeared in the December 1941 issue of the *Journal Cactus and Succulent Society of America*, was reprinted in the February 19 number of *American Eagle* (**36**:1, 4-5).

While the winter has not been unusually severe there have been several brief spells combining intense cold, bright sunshine and no snow blanket. It is too early to give an exact account of the damage due to these conditions, but a number of ornamental plants have apparently been very severely injured, particularly broad-leaved evergreens.

A special meeting and exhibit of the American Orchid Society was held on February 18 and 19 at the Fairchild Tropical Garden, Miami, Florida. For the exhibit the Garden sent a spray of the rare *Oncidium Powelli* from Panama and the following varieties of Dendrobium grown from seed in St. Louis:

Dendrobium nobile virginale alba
Dendrobium nobile Ballianum
Dendrobium nobile Rolfae
Dendrobium nobile Ainsworthi
Dendrobium nobile Cassiope
Dendrobium nobile gigantea
Dendrobium Thwaitesae X Thwaitesae-Veitchi, light variety
Dendrobium Thwaitesae X Thwaitesae-Veitchi, dark variety
Dendrobium Ainsworthi grandiflora
Dendrobium Armstrongae X Wardianum
Dendrobium Merlin X Wardianum
Oncidium Powelli—Panama

STATISTICAL INFORMATION FOR FEBRUARY, 1942

GARDEN ATTENDANCE:	
Total number of visitors	7,795
PLANT ACCESSIONS:	
Total number of plants, seed packets, and bulbs received as gifts	327
LIBRARY ACCESSIONS:	
Total number of books and pamphlets bought	13
Total number of books and pamphlets donated	566
HERBARIUM ACCESSIONS:	
By Purchase—	
Eyerdam, Walter J.—Plants of Alaska and South America	425
Hoogstraal, Harry—Plants of Mexico	717
Lundell, C. L.—Plants of Mexico	350
Woodson, R. E. Jr.—Plants of Panama	1,125
By Gift—	
Anderson, Edgar—Photograph and illustrations of plants	31
Babcock, E. B.—American and exotic specimens of *Crepis*	21
Braun, E. Lucy—Plants of Kentucky	4
Brenckle, J. F.—Flowering plants and Lichens	623
Greenman, J. M.—Photograph of types of *Malvaviscus lanceolata* Rose	1
Le Page, Ernest—*Parmelia conspersa* (Ehrh.) Ach. from Canada	1
McVaugh, Rogers—Lichens of Georgia	29
By Exchange—	
State College of Washington, by Marion Ownbey—Plants of the Northwest	492
Tolstead, W. L.—Plants of Nebraska	105
University of Michigan, by C. L. Lundell—Plants of Wyoming, Texas and Mexico	485
West Virginia University, by E. L. Core,—Plants of Michigan and West Virginia	100
Williams, L. O.—Orchids of Burma and Panama	2
By Transfer—	
Cutak, Lad—*Osmanthus fragrans* Lour. from Horticulture	1
Total	4,512

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Missouri Botanical Garden Bulletin

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Missouri Botanical Garden Bulletin

Vol. XXX APRIL, 1942 No. 4

CONTINUOUS BLOOM IN ST. LOUIS GARDENS

A well-designed garden does not depend upon flowers to maintain its interest but we must admit that we enjoy the plants more when they are in bloom. Each year, when we plan our gardens, we try to include various combinations of plants with similar blooming periods, and if we succeed we are gratified. Those of us who have gardened for many years are familiar with the habits and the blooming periods of many plants which can be grown in St. Louis. If gardening is new to us or if we have recently moved to this vicinity, it is only through trial and error that we gradually acquire some of the knowledge with which the seasoned gardener seems to be so richly endowed.

Most of the gardening literature originates in the East and is written for that region. We live a thousand miles inland and away from any large body of water. Our climatic conditions are naturally different and our spring season precedes that of the East by two weeks to a month. When we read of dogwood blooming in mid-May and bearded iris in June we know that such a statement cannot be meant for St. Louis.

The robin, red-winged blackbird, meadowlark and martin herald the spring season of the feathered kingdom. Likewise, among the plants we have certain favorites that point the way to an early or late spring. If the cornelian cherry *(Cornus mas)* and forsythia bloom in early March, then we may expect the magnolias, redbud and dogwood to bloom early. Unfortunately, such a premature spring is sometimes cut short by a freeze. Native plants are accustomed to the vagaries of the local spring weather and survive but the foreign plants, such as the lilacs and magnolias, are stimulated by warm weather in March and rush into bloom only to be frozen later.

Certain plants dominate the garden picture at intervals throughout the growing season. We have a fine selection of small trees which bloom profusely in April, notably the redbud, magnolia, dogwood, flowering almond, cherry, crabapple, peach, pear and plum. At the same time under the trees and in flower borders the narcissi are in their prime, being replaced by

the cottage and Darwin tulips in late April. Iris, peonies and poppies are the dominant plants during May. In June we have delphiniums, hollyhocks, phlox and roses, and in July and August the daylilies and annuals. September and October are the months of the aster and chrysanthemum.

Notebook and picture records, kept through the years, provide the data for the average blooming period of plants grown in the St. Louis region as set forth in this article.

MARCH 1-15

The first half of March is usually cold and only a few plants are in flower. We may have snowdrops *(Galanthus nivalis)* and the winter aconite *(Eranthis hyemalis)*, both being bulbous plants which will bloom even in February in sheltered places. Of the shrubs, pussywillow and the vernal witch-hazel come in February and early March.

MARCH 15-31

Crocus, glory-of-the-snow *(Chionodoxa Luciliae)*, Siberian squill *(Scilla sibirica)* and narcissi will bloom during this period. February Gold and La Vestale are among the earliest narcissi to open. The Cornelian cherry *(Cornus mas)* usually bursts into bloom at this time and is followed closely by forsythia. Next come the shadbush *(Amelanchier canadensis)*, winter honeysuckle *(Lonicera fragrantissima)* and the star magnolia *(Magnolia stellata)*.

APRIL 1-15

Plants which bloom in late March continue into April if the weather remains cool. Many narcissi flower in early April, a few of them being Aerolite, Dawson City, Lord Kitchener, Mi-careme, Silver Star and Twink. The dwarf bearded iris commence blooming at this time and gradually merge with the intermediate varieties in late April. Iris and narcissi may be had for several weeks if selections are made from the early and late varieties. Dwarf moss-pink *(Phlox subulata)* has a long season, from early April until mid-May.

Shrubs and trees which bloom at this time are forsythia, *Magnolia stellata* and *Magnolia Soulangeana*, fragrant sumac *(Rhus canadensis)*, *Spiraea Thunbergi* and the native plum *(Prunus americana)*.

APRIL 15-30

Anchusa myosotidiflora combines well with narcissi. The flowers are similar to forget-me-nots in color and shape, but their stalks are a foot tall. The large leaves remain in good condition during the entire summer. Among the low-growing perennials we may choose golden-tuft *(Alyssum saxatile)*,

rock-cress *(Arabis albida)*, *Aubrieta deltoidea*, *Cerastium tomentosum*, *Dicentra eximia*, dwarf iris, evergreen candytuft *(Iberis sempervirens)*, primroses, *Verbena canadensis* and violets. An excellent ground cover is *Vinca minor*, particularly the variety BOWLES, which has larger and darker blue flowers. Among the taller perennials are our native columbine *(Aquilegia canadensis)*, bleeding heart *(Dicentra spectabilis)*, leopards-bane *(Doronicum caucasicum)*, our native bluebell *(Mertensia virginica)* and Greek valerian *(Polemonium reptans)*.

Bulbs that bloom in late April are the spring snowflakes *(Leucojum aestivum)*, grape-hyacinths *(Muscari botryoides)*, common hyacinths *(Hyacinthus orientalis)*, narcissi and tulips. A few late narcissi are CRIMSON BRAID, DIANA KASNER, FIRETAIL, PEARLY QUEEN and SEAGULL.

Some good shrubs are the flowering quince or burning bush *(Chaenomeles lagenaria)*, *Kerria japonica*, *Ribes aureum*, many hybrid lilacs, snowball *(Viburnum Opulus* var. *roseum)* and the fragrant *Viburnum Carlesii*, wisteria in vine or tree form and *Xanthoceras sorbifolia*.

Deciduous azaleas, such as the "mollis" hybrids and *Rhododendron nudiflorum*, bloom in late April and early May. The "mollis" azaleas are striking in their color range of yellow, orange and salmon, and on this account it might be well to caution against planting them too freely.

There probably are no native trees more conspicuous in our spring landscape than redbud and dogwood. Redbud comes first, and in late April the dogwood. For profusion of bloom the various Asiatic crabs have no equal in the April garden. These are mostly small, spreading trees usually not much over twelve feet in height. The cherries, the double-flowering peaches in white, pink and red and the silver-bell *(Halesia carolina)* also bloom at the same time.

MAY 1-15

After the season opens in late March there is a gradual increase in the number and variety of blooming plants until the climax is reached about the third week in May. Excellent bulbous plants which bloom in early May are the Spanish bluebells *(Scilla hispanica)* in blue, pink and white. The intermediate iris are gradually replaced by the early tall-bearded varieties. Tree peonies bloom in April or early May and are followed by the herbaceous types. Some of the first daylilies are TANGERINE and ORANGEMAN. For early varieties of Siberian iris we may select LADY NORTHCLIFFE, MRS. GRAY HILL, MRS. SAUNDERS, PLUTON and SKYROCKET. A few other perennials are sweet rocket *(Hesperis matronalis)*, catmint *(Nepeta Cataria)*, the oriental poppy OLYMPIA, and soapwort *(Saponaria ocymoides)*, which forms large mats of tiny pink flowers.

From the shrubs which bloom at this time we may choose the fringe-tree *(Chionanthus virginica)*, beauty-bush *(Kolkwitzia amabilis)*, *Rosa Hugonis* and Harison's yellow rose, little-leaf lilac *(Syringa microphylla)*, *Spiraea Vanhouttei*, Tamarix and Weigela.

In early May the red and white horse-chestnuts *(Aesculus carnea* and *A. Hippocastanum)* attract a great deal of attention, while numerous species of hawthorns are literally blanketed with white and pink flowers.

MAY 15-31

This portion of the calendar is so crowded with good plant material that it becomes a problem of selecting the most satisfactory for our individual gardens. For background material there is false indigo *(Baptisia australis)*, gas-plant *(Dictamnus albus)* and peonies, both the single and double-flowered varieties. All these plants grow three or more feet tall, and their foliage will last through the season.

For perennials with foliage of intermediate height but with tall flower stalks we might use columbine *(Aquilegia hybrida)*, garden heliotrope *(Heliotropium arborescens)*, *Hemerocallis flava* and the variety, QUEEN OF MAY, the innumerable varieties of tall bearded iris, Siberian iris such as BLUE KING, PAPILLON, PERRY'S BLUE and SNOW QUEEN, the yellow flag *(Iris Pseudacorus)*, lupines and oriental poppies.

Some of the more dwarf perennials are *Ajuga genevensis* and *A. reptans*, thrift or sea-pink *(Armeria* sp.), the various campanulas such as *Campanula carpatica*, *C. garganica* and *C. rotundifolia*, carnations and pinks *(Dianthus caesius*, *D. deltoides* and *D. latifolius)*, single or double dropwort *(Filipendula hexapetala)*, the hybrid geums, flax *(Linum perenne)*, beard-tongue *(Penstemon* sp.), pyrethrum and dwarf Veronicas.

The first lilies to bloom are *Lilium elegans*, *L. tenuifolium* and *L. umbellatum*.

Among the shrubs we have deutzias, honeysuckles, philadelphus, rose acacia *(Robinia Kelseyi)*, rugosa roses and the late lilac species *(Syringa villosa)*. The large-flowered hybrid rhododendrons bloom at this time.

Perennial vines blooming the first part of May are the large-flowered clematis such as *Lawsoniana* and RAMONA, *Lonicera japonica* var. *Halliana*, the hybrid honeysuckle GOLDFLAME, *Lonicera sempervirens* and the large-flowered climbing roses ALIDA LOVETT, CHRISTINE WRIGHT, CLIMBING AMERICAN BEAUTY, DOUBLOONS, DR. HUEY and PAUL'S SCARLET CLIMBER.

A beautiful tree which flowers at this time is the yellow-wood *(Cladrastis lutea)*.

JUNE 1-15

We still have a good many flowers in June but the colorful gardens of

May are past and cannot be equaled until another year rolls around. The fernleaf yarrow *(Achillea filipendulina)* and varieties of *Achillea Ptarmica* are good plants for the June flower border, as are coreopsis, gaillardias and delphiniums. An attractive plant is *Heuchera sanguinea,* commonly called coral-bells. Daylilies which bloom in the first half of June are: DOVER, LADY HESKETH, ORANGE GLOW, and the species, *Hemerocallis fulva.* We may still have iris at this time if we grow *Iris ochroleuca* and the large single and double Japanese iris. *Lychnis chalcedonica* (maltese cross) and *Lychnis Coronaria* (mullein-pink) are two effective garden plants. The first tall white phlox of the season is MISS LINGARD. The Stokes aster *(Stokesia laevis)* blooms for a long time. Three tall yellow perennials are *Thalictrum glaucum, Thermopsis caroliniana* and the hybrid mulleins or Verbascum. The white and pink garden heliotropes are *Valeriana officinalis* and *Centranthus ruber. Veronica spicata* and the fine variety BLUE SPIRES are good blue perennials of medium height.

June is the month for the beautiful madonna and regal lilies and also for *Lilium canadense, L. croceum* and *L. pardalinum.*

Trees which bloom in June are the catalpa and locust. The early magnolias are sometimes ruined by late frosts but the sweet bay *(Magnolia virginiana)* flowers each year at this time. All the hybrid perpetual, polyantha and hybrid tea roses commence to bloom in late May and continue into June, which is considered the month of roses. The climbing roses of the cluster-flower type, of which DOROTHY PERKINS is a well-known example, are the roses which bloom so profusely in June.

JUNE 15-30

Perennials which reached their maximum development in early June still carry on but they no longer bloom as freely. One of the later plants is *Gypsophila* BRISTOL FAIRY, which forms great mounds of misty white flowers four to five feet in diameter. In the shade are the plantain lilies *(Hosta caerulea* and *H. Sieboldiana).* The hybrid daylilies are indispensable in late June and July. Varieties such as BAY STATE, D. D. WYMAN, FLORHAM, *Luteola major,* RADIANT, SHIRLEY and SIR MICHAEL FOSTER are excellent. The many tall phlox are now in season, but they will need an abundance of water to keep them in good condition.

Hydrangea arborescens, Rosa setigera and *Sambucus canadensis* bloom in late June.

A conspicuous tree is the varnish-tree *(Koelreuteria paniculata),* with its panicles of golden-yellow flowers.

JULY 1-15

Shasta daisies are now in season. With them one could plant the native

cone-flower *(Echinacea purpurea)*. Two tall perennials are the globe thistle *(Echinops Ritro)* and the sea holly *(Eryngium amethystinum)*. Some of the finest daylilies bloom in July. We have a choice of the varieties CINNABAR, GEORGE YELD, GYPSY, HYPERION, OPHIR, and the species, *Hemerocallis Thunbergii*. The old-fashioned tiger lily *(Lilium tigrinum)* also blooms in July. The purple loosestrife *(Lythrum Salicaria* var. *roseum)* grows three to four feet tall and is in flower for many weeks.

JULY 15-31

If our gardens are large, bold masses of plume poppy *(Bocconia cordata)* are effective. The creamy white panicles of flowers terminate stalks which attain a height of about eight feet. The giant mallows *(Hibiscus Moscheutos)* in white, pink and rose are good garden subjects for July.

The various buddleias bloom from July until frost. CHARMING, FORTUNE and ILE DE FRANCE are three excellent varieties. *Vitex Agnus-castus*, or chaste-tree, is a shrub that produces its lavender-blue flowers from July until fall. Buddleia and Vitex require the same treatment. They usually freeze to the ground each winter, and even though some of the canes are alive in the spring they should all be cut off near the ground. The false spireas, which are species of Sorbaria, bear large panicles of white flowers during the summer months.

AUGUST 1-15

An interesting little iris that blooms in August is the vesper iris *(Iris dichotoma)*. The individual flowers open in the afternoon for only a few hours but there is a succession of flowers for several weeks. *Hemerocallis multiflora*, a small-flowered daylily, blooms at this time. The blazing star or gayfeather *(Liatris pycnostachya)* grows about four feet tall and has long spikes of purple flowers. An interesting bulbous plant is the hardy amaryllis *(Lycoris squamigera)*.

A fine ornamental tree for August is the pagoda tree *(Sophora japonica)*. The long panicles of white pea-shaped flowers appear in early August.

AUGUST 15-31

Some of the fall asters begin blooming in late August. Artemisia SILVER KING is a very showy plant with its silvery-white foliage. A dwarf perennial with indigo-blue flowers is leadwort *(Plumbago Larpentae* as listed in catalogs*)*. *Hosta plantaginea* produces fragrant white flowers at this time. One of the last daylilies of the season is *Hemerocallis* BOUTONNIERE. *Lilium philippinense* blooms in late August and early September.

The shrub althea or Rose-of-Sharon *(Hibiscus syriacus)* blooms in August.

SEPTEMBER 1-15

If color is to be maintained in the garden during August and September many of the annuals must supplement the perennials. While there always are some perennials in bloom, the number is limited. In September the various asters or Michaelmas daisies begin blooming, and one may use dwarf or tall varieties.

Two vines which bloom at this time are *Clematis paniculata* and the silver lace-vine *(Polygonum Auberti)*.

SEPTEMBER 15-30

Two pink perennials which bloom in September are the false dragon-head *(Physostegia virginiana* and the hybrid VIVID*)* and the showy sedum *(Sedum spectabile)*. The dark pink form of sedum is far superior to the common variety.

A perennial of shrub-like proportions which blooms at this time is *Desmodium penduliflorum* as listed in catalogs. It freezes to the ground each year but its growth is rapid. By fall the plant stands four to five feet tall, with long arching stems studded with rose-purple flowers.

OCTOBER 1-15

At this time of the year the hardy chrysanthemums supply most of the color in the garden. Among the first to bloom are AMELIA, APHRODITE, BARBARA CUMMING, CERES, MERCURY, PYGMY GOLD, SEPTEMBER QUEEN and SUWANEE.

Aster tataricus is a tall perennial which flowers in early October. Equally as tall and blooming at the same time is *Helianthus Maximiliani.*

OCTOBER 15-31

The first frost usually occurs during this period. If it is a light frost many of the chrysanthemums will continue to bloom. Some of the later varieties of chrysanthemums are AGNES SELKIRK CLARK, BARNEGAT, GRENADIER, MRS. H. HARRISON, NORMANDIE, RUTH CUMMING and VENUS.

Because of the possible confusion in plant terminology it has seemed advisable to use names as they are commonly known among horticulturists or as they are listed in Bailey's "Hortus," Rehder's "Manual of Cultivated Trees and Shrubs," and nurserymen's catalogs.

The following tabular list gives the blooming period in the St. Louis region of a good many herbaceous perennials, vines, shrubs and trees.

SCIENTIFIC NAME	COMMON NAME	COLOR
	MARCH 1-15	
Galanthus nivalis	Snowdrop	White
Eranthis hyemalis	Winter aconite	Yellow
SHRUBS		
Hamamelis vernalis	Witch-hazel	Yellow or red
Salix discolor	Pussywillow	Silvery gray
	MARCH 15-31	
Crocus		Lavender, yellow, white
Chionodoxa Luciliae	Glory-of-the-snow	Blue
Narcissus FEBRUARY GOLD and LA VESTALE		Yellow, white
Scilla sibirica	Squill	Blue
SHRUBS		
Cornus mas	Cornelian cherry	Yellow
Forsythia intermedia and *ovata*	Golden-bell	Yellow
Lonicera fragrantissima	Winter honeysuckle	White
Amelanchier canadensis	Shadbush	White
	APRIL 1-15	
Iris (dwarf bearded)		Purple, white, yellow
Narcissus		Yellow, white
Phlox subulata	Moss-pink	Blue, pink, rose, white
SHRUBS		
Rhus canadensis	Fragrant sumac	Yellow
Spiraea Thunbergii	Thunberg spirea	White
Magnolia stellata	Star magnolia	White
TREES		
Magnolia Soulangeana	Saucer magnolia	Rose and white
Prunus americana	Native plum	White
	APRIL 15-30	
Alyssum saxatile	Golden-tuft	Yellow
Anchusa myosotidiflora	Alkanet	Blue
Anemone Pulsatilla	Pasque flower	Lavender
Aquilegia canadensis	Common American columbine	Red and yellow
Arabis albida	Rock-cress	White
Aubrieta deltoidea		Lilac or purple
Cerastium tomentosum	Snow-in-summer	White
Dicentra eximia	Plumed bleeding heart	Pink
Dicentra spectabilis	Bleeding-heart	Pink
Doronicum caucasicum	Leopards-bane	Yellow
Hyacinthus orientalis	Common hyacinth	Various colors
Iberis sempervirens	Evergreen candytuft	White
Iris cristata	Crested iris	Blue
Iris (intermediate bearded varieties)		Various colors
Leucojum aestivum	Spring snowflake	White
Mertensia virginica	Native bluebell	Blue and pink
Muscari botryoides	Grape hyacinth	Blue, rose, white
Narcissus		White, yellow
Phlox divaricata	Wild Sweet William	Blue
Polemonium reptans	Greek Valerian	Blue
Primula veris and *P. Kleynii*	Cowslip	Yellow
Tulipa	Tulips	Various colors
Verbena canadensis	Clump verbena	Reddish-purple

SCIENTIFIC NAME	COMMON NAME	COLOR
Vinca minor	Running myrtle	Blue, white
Viola sp.	Violets	Blue
SHRUBS		
Aronia floribunda	Chokeberry	White
Azalea ("Mollis" hybrids)	Chinese azalea	Orange, salmon, yellow
Chaenomeles lagenaria	Flowering quince	Red, scarlet
Kerria japonica		Yellow
Prunus glandulosa	Flowering almond	Pink and white
Ribes aureum	Golden currant	Yellow
Syringa	Hybrid lilacs	Lilac, rose, white
Viburnum Opulus var. *roseum*	Snowball	White
Viburnum Carlesii		Pale pink
Xanthoceras sorbifolia		White
Wistaria sinensis	Wisteria	Blue-violet
TREES		
Cercis canadensis	Redbud	Rosy-pink and white
Cornus florida	Flowering dogwood	Pink, white
Halesia carolina	Silver-bell	White
Malus, various species	Flowering crabs	Red to white
Prunus, various species	Flowering cherries	Pink, rose, white
Prunus persica	Double-flowering peach	Pink, red, white
MAY 1-15		
Geranium maculatum	Cranesbill	Pink
Hemerocallis hybrids—		
TANGERINE, ORANGEMAN		Yellow
Hesperis matronalis	Sweet rocket	Lilac, white
Iris sibirica—	Siberian iris	Blue, white
LADY NORTHCLIFFE, MRS. GRAY HILL, MRS. SAUNDERS, PLUTON, SKYROCKET		
Nepeta Cataria	Catmint	Pale blue
Papaver orientale OLYMPIA	Oriental poppy	Orange scarlet
Paeonia suffruticosa	Tree peony	Various colors
Paeonia species	Herbaceous peonies	Various colors
Saponaria ocymoides	Soapwort	Pink
Scilla hispanica	Spanish bluebell	Blue, pink, white
SHRUBS		
Chionanthus virginica	Fringe-tree	White
Diervilla species	Weigela	Red, rose, white
Kolkwitzia amabilis	Beauty-bush	Pale pink
Lonicera Korolkowii	Blue-leaf honeysuckle	Rose
Lonicera Morrowi	Morrow honeysuckle	White
Rosa Hugonis	Hugo rose	Yellow
Rosa Harisonii	Harison's yellow rose	Yellow
Spiraea Vanhouttei		White
Syringa microphylla	Little-leaf lilac	Lilac
Tamarix parviflora (*T. africana*)		Light pink
TREES		
Aesculus carnea	Red horse-chestnut	Red
Aesculus Hippocastanum	Common horse-chestnut	White
Crataegus species	Hawthorn	Red and white
MAY 15-31		
Ajuga genevensis, A. reptans	Bugle-weed	Blue
Aquilegia hybrida	Columbine	Various colors
Armeria species	Thrift	Rose, white
Baptisia australis	False indigo	Indigo-blue
Campanula carpatica	Bellflower	Blue, white
Campanula garganica		Blue
Campanula rotundifolia	Harebell	Blue, white

SCIENTIFIC NAME	COMMON NAME	COLOR
Chrysanthemum roseum	Pyrethrum	Rose, white
Clematis Lawsoniana		Rose-purple
Clematis RAMONA		Pale-blue
Dianthus caesius	Cheddar pink	Rose
Dianthus deltoides	Maiden pink	Pink, red, white
Dianthus latifolius		Pink to red
Dictamnus albus	Gas-plant	Rosy-purple, white
Filipendula hexapetala	Dropwort	White
Geum chiloense	Avens	Orange-red, yellow
Heliotropium arborescens	Garden heliotrope	White
Hemerocallis flava	Tall yellow daylily	Yellow
Hemerocallis hybrids— APRICOT, AUREOLE, QUEEN OF MAY, SOVEREIGN		
Iris (tall bearded varieties)		Various colors
Iris Pseudacorus	Yellow flag	Yellow
Iris sibirica— BLUE KING, PAPILLON, PERRY'S BLUE, SNOW QUEEN		
Lilium elegans		Various colors
Lilium tenuifolium	Coral lily	Bright scarlet
Lilium umbellatum		Yellow to orange-red
Linum perenne	Flax	Blue
Lupinus polyphyllus	Lupine	Blue, rose, white
Nymphaea	Hardy water-lilies	Rose, white, yellow
Papaver orientale	Oriental poppy	Various colors
Penstemon species	Beard-tongue	Various colors
Veronica species	Speedwell	Blue
SHRUBS AND VINES		
Deutzia gracilis		White
Deutzia Lemoinei		White
Deutzia scabra		Pink, white
Lonicera japonica var. *Halliana*	Hall's honeysuckle	White
Lonicera GOLDFLAME		Flame-pink and yellow
Lonicera sempervirens	Trumpet honeysuckle	Orange-scarlet
Philadelphus coronarius	Mock-orange	White
Philadelphus grandiflorus	Big scentless mock-orange	White
Philadelphus Lemoinei var. AVALANCHE		White
Philadelphus virginalis	Virginal mock-orange	White
Robinia Kelseyi		Rose-colored
Rhododendron (large-flowered hybrid types)		Lavender, red, white
Rosa species	Roses (hybrid perpetual, rugosa and large-flowered climbing roses)	Various colors
Syringa villosa		Lilac
TREES		
Cladrastis lutea	Yellow-wood	White

JUNE 1-15

Achillea filipendulina	Fernleaf yarrow	Yellow
Achillea Ptarmica	Sneezewort	White
Althaea rosea	Hollyhock	Various colors
Anchusa azurea	Alkanet	Blue
Campanula medium	Canterbury bells	Blue, pink, white
Centranthus ruber	Red Valerian	Crimson
Clematis Jackmani		Violet-purple
Coreopsis grandflora	Tickseed	Yellow

SCIENTIFIC NAME	COMMON NAME	COLOR
Delphinium species		Blue, pink, white
Dianthus barbatus	Sweet William	Various colors
Digitalis purpurea	Foxglove	Various colors
Gaillardia hybrids	Blanket-flower	Orange, red, yellow
Hemerocallis fulva	Tawny daylily	Orange-red
Hemerocallis hybrids— DOVER, LADY HESKETH, ORANGE GLOW		
Heuchera sanguinea	Coral-bells	Crimson, rose, white
Iris Kaempferi	Japanese iris	Various colors
Iris ochroleuca		White
Lilium canadense		Yellow, orange
Lilium candidum	Madonna lily	White
Lilium croceum	Orange lily	Orange
Lilium pardalinum	Leopard lily	Orange
Lilum regale	Royal lily	White
Lychnis chalcedonica	Maltese cross	Scarlet
Lychnis Coronaria	Mullein-pink	Crimson
Phlox suffruticosa MISS LINGARD		White
Rosa species	Roses (hybrid tea and climbing varieties)	Various colors
Stokesia laevis	Stokes aster	Purplish-blue
Thalictrum glaucum		Yellow
Thermopsis caroliniana	Carolina lupine	Yellow
Valeriana officinalis	Garden heliotrope	White
Verbascum hybrids	Mullein	Amber, old rose, yellow
Veronica spicata	Speedwell	Blue
Yucca filamentosa	Adam's needle	White
SHRUBS		
Amorpha fruticosa	False indigo	Purple
TREES		
Catalpa bignonioides	Common catalpa	White
Magnolia virginiana	Sweet-bay	White
Robinia pseudoacacia	Black locust	White
JUNE 15-30		
Callirhoe involucrata	Poppy mallow	Red-purple
Cimicifuga racemosa	Snakeroot	White
Gypsophila paniculata	Baby's breath	White
Hemerocallis hybrids— BAY STATE, D. D. WYMAN, FLORHAM, *Luteola major*, RADIANT, SHIRLEY, SIR MICHAEL FOSTER		
Hosta caerulea	Blue plantain-lily	Blue
Hosta Sieboldiana	Short-cluster plantain-lily	Pale lilac
Phlox decussata	Tall phlox	Various colors
SHRUBS		
Aesculus parviflora	Dwarf horse-chestnut	White
Hydrangea arborescens grandiflora	Snowhill hydrangea	White
Rosa setigera	Prairie rose	Rose
Sambucus canadensis	American elder	White
TREES		
Koelreuteria paniculata	Varnish-tree	Yellow
JULY 1-15		
Asclepias tuberosa	Butterfly-weed	Orange
Chrysanthemum maximum	Shasta daisy	White
Echinacea purpurea	Purple coneflower	Purple
Echinops Ritro	Globe thistle	Metallic blue

SCIENTIFIC NAME	COMMON NAME	COLOR
Eryngium amethystinum	Sea holly	Blue
Hemerocallis hybrids—		
CINNABAR, GEORGE YELD,		
GYPSY, HYPERION, OPHIR		
Hemerocallis Thunbergii	Late yellow daylily	Yellow
Lilium tigrinum	Tiger lily	Salmon-red
Lythrum Salicaria var. *roseum*	Purple loosestrife	Rose-purple
Platycodon grandiflorum	Balloon-flower	Deep blue or white
JULY 15-31		
Bocconia cordata	Plume poppy	Creamy white
Hibiscus Moscheutos	Giant mallow	Pink, rose, white
Statice latifolium	Sea-lavender	Blue-purple
SHRUBS		
Buddleia hybrids—		
CHARMING		Lavender-pink
DUBONNET		Rose-purple
FORTUNI		Lilac, orange eye
ILE DE FRANCE		Rose-purple
Hydrangea paniculata grandiflora	Peegee hydrangea	White
Sorbaria arborea glabrata	False spirea	White
Vitex Agnus-castus	Chaste-tree	Lavender-blue
AUGUST 1-15		
Hemerocallis multiflora	Daylily	Yellow
Iris dichotoma	Vesper iris	Lavender-blue
Liatris pycnostachya	Gayfeather	Purple
Lycoris squamigera	Hardy amaryllis	Rose-lilac
Salvia Pitcheri	Sage	Gentian-blue
TREES		
Sophora japonica	Pagoda tree	White
AUGUST 15-31		
Artemisia albula	SILVER KING Artemisia	White-tomentose foliage
Aster Frikarti		Lavender-blue
Begonia Evansiana	Hardy begonia	Pink
Cassia marilandica	Indian senna	Yellow
Ceratostigma plumbaginoides (*Plumbago Larpentae*)	Leadwort	Gentian-blue
Clematis heracleaefolia var. *Davidiana*	Shrubby clematis	Blue
Hosta plantaginea	Fragrant plantain-lily	White
Hemerocallis hybrid—		
BOUTONNIERE	Daylily	Yellow
Lilium philippinense		White
SHRUBS		
Hibiscus syriacus	Rose-of-Sharon	Purple, rose, white
SEPTEMBER 1-15		
Aster species	Michaelmas daisy	Blue, purple, red, white
Clematis paniculata		White
Polygonum Auberti	Silver lace-vine	White
SEPTEMBER 15-30		
Physostegia virginiana VIVID	False dragonhead	Deep pink
Sedum spectabile	Showy sedum	Rose
Desmodium penduliflorum		Rose-purple

SCIENTIFIC NAME	COMMON NAME	COLOR
	OCTOBER 1-15	
Aster tataricus	Tatarian aster	Blue-purple
Chrysanthemum—		
AMELIA		Single pink
APHRODITE		Single pink
BARBARA CUMMING		Bronze-yellow
CERES		Chamois-colored
MERCURY		Copper-red
PYGMY GOLD		Double yellow
SEPTEMBER QUEEN		Double white
SUWANEE		Single white
Helianthus Maximiliani		Golden-yellow
	OCTOBER 15-31	
Chrysanthemum—		
AGNES SELKIRK CLARK		Single apricot-pink
BARNEGAT		Double yellow
GRENADIER		Single crimson-red
MRS. H. HARRISON		Double white
NORMANDIE		Double white
RUTH CUMMING		Double reddish-bronze
VENUS		Single orchid-pink

P. A. K.

BLIND CHILDREN ENJOY THE FLOWER SHOW

As in former years, pupils from the Missouri School for the Blind were guided through the Greater St. Louis Flower and Garden Show held at the Arena, March 15-22. Few realize what pleasure and satisfaction these children are able to derive from such a show, when the flowers are properly presented to them. The following letter, written in Braille, to Mr. Pring, Superintendent of the Missouri Botanical Garden, who conducted the pupils, will give some idea of how much they were able to see through their fingers and what the experience meant to them.

3815 Magnolia Ave.
St. Louis, Mo.
March 21, 1942

Dear Mr. Pring:

You'll never know how much we enjoyed the flower show last Thursday. Your explanations were perfect, and we really know a lot about the flowers, especially the pitcher-plant. Every pupil in the school is interested in that. We surely like the plants, Mr. Pring. Don't forget to send one over after the show!

Everyone admired the pretty bouquet of carnations, too. We'll never forget what we learned about them.

My lovely orchid was very popular with every person here. Hardly any one has ever received an orchid such as this. Those flowers are rare like dear you, and I know every girl is nearly thrilled to death who receives one. I was just comparing you with the lovely orchid, Mr. Pring. Although I like it very much, I think there is nothing like making a new friend such as you. Friends don't wither, flowers do.

We nearly forgot to remind you to be standing by at your radio at 2:30 this afternoon. All four of us will have an appointment then. We are very anxious to know what we sound like and we wonder if your voice will sound very natural.

Since this is the first day of spring, let us be the first to wish you lots of luck with your flowers.

Your Pals,

Bill, Evelyn, and Velma.

NOTES

Mr. Paul A. Kohl, Floriculturist to the Garden, showed motion-pictures, "Four Seasons in the Garden," before the Webster Groves Garden Club, April 8.

Dr. David C. Fairburn, Horticulturist to the Garden, spoke before the Green Thumb Garden Club, at Clayton, Mo., March 9, on "Garden Arrangement and Planting."

Mr. Ladislaus Cutak, in charge of Succulents at the Garden, has an article "Courage in War and Courage in Plants" in the April number of *Garden Life* (**15:** 31-32).

Dr. Edgar Anderson, Geneticist to the Garden, participated in a Garden Clinic and Panel Discussion conducted by the Webster Groves Garden Club, on March 6, for the members of the groups in the eighth district of Federated Garden Clubs.

Recent visitors to the Garden include: Professor T. G. Yuncker, Head, Department of Botany, De Pauw University, Greencastle, Ind.; Dr. George B. Happ, Assistant Professor of Biology, Principia College, Elsah, Ill.; Dr. A. Fromm, O. F. M., St. Joseph College, Chicago, Ill.

Dr. George T. Moore, Director of the Garden, gave a talk to the American Association of University Women, at St. Charles, Mo., March 5, on "Botanical Gardens—Why and What They Are"; and before the Men's Round Table, Church of the Holy Communion, March 9, on "Henry Shaw and His Garden."

Mr. George H. Pring, Superintendent of the Garden, spoke before the Junior Woman's Club of Carondelet, March 9, on "Flowers and Insects"; before the Salem Woman's Club, Salem, Ill., March 10, on "Planting Victory Gardens"; and over Radio Station KMOX, March 14, on "New Introductions at the Flower Show", March 16, "The Flower Show", and March 18, "With the School for the Blind at the Flower Show."

On March 5, Mr. George H. Pring, Superintendent of the Garden, assisted in organizing an Air-Raid Post Warden's School at the Wade School, this school being in Zone 2 where the Garden is located. The illustrated lecture on "Basic Training in Air-raid Precautions", given by him at the meeting and for which the Garden made the slides, was repeated at the Bryan Mullanphy School on March 18, at the Men's Club, Tyler Place Presbyterian Church, March 19, and at the Post Warden's School at the Y. M. C. A. (Zone 6), on March 27.

The following articles or excerpts of articles from the Garden BULLETIN have been reprinted in other horticultural magazines recently: "Thrilling Tales of Orchid Collection", in the March *Garden Forum* (**4**:7); "The

Hawthorn, Missouri's State Flower," in the March *Madison Cooper's Gardening Magazine* (**6**:54); frontispiece illustration of a Wardian case of Orchids, in the February number of *Wisconsin Horticulture;* and "A Trip to the Land of Swaying Palms", in the March 12 number of *American Eagle* (**36**:1, 4-5).

STATISTICAL INFORMATION FOR MARCH, 1942

GARDEN ATTENDANCE:	
Total number of visitors	17,607
PLANT ACCESSIONS:	
Total number of plants, seed packets, and bulbs received as gifts	474
LIBRARY ACCESSIONS:	
Total number of books bought	10
Total number of books and pamphlets donated	642
HERBARIUM ACCESSIONS:	
By Purchase—	
University of California, by T. H. Goodspeed—Plants of South America	1,143
By Gift—	
Anderson, E.—Plants of Illinois and of horticulture	4
Berry, E. C.—Plant of horticulture	1
Botanical Museum of Harvard University, by L. O. Williams—*Epidendrum miserum* Lindl. from Mexico	1
Demaree, Delzie—Plants of Arkansas	16
Dixon, Royal—*Medicago arabica* (L.) Huds. from Texas	1
Dudley Herbarium—Plants of California, Nevada and Arizona	5
Garrett, A. O.—Plants of Utah and Arizona	21
James, Leslie—Plants of Alabama	2
June, M. A.—Plant of Louisiana	1
Lenz, L. W.—Plants of Montana	20
Lundell, C. L.—Apocynaceae and Asclepiadaceae from Texas	11
Martinez, Maximino—Plant of Mexico	1
Muller, C. H.—Plants of United States	200
Ownbey, Marion—Plants of Washington	2
By Exchange—	
Field Museum of Natural History—Miscellaneous duplicates	268
Gray Herbarium of Harvard University—"Plantae Exsiccatae Grayanae," Cent. XII	100
Miscellaneous duplicates	81
Kansas State College, by F. C. Gates—Plants of Michigan and Kansas	120
New York Botanical Garden—Photographs of type specimens of *Strychnos*	13
University of California, Berkeley—Plants of California	336
By Transfer—	
Cutak, Lad.—*Mangifera indica* L. from horticulture	4
Total	2,351

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date until his death in 1889 it was maintained under his personal direction. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was chosen by Mr. Shaw and he definitely indicated that he wished it called by that name. The Garden passed at his death into the hands of a Board of Trustees, designated in Mr. Shaw's will, and the Board so constituted, exclusive of certain ex-officio members, is self perpetuating. By a further provision of the will the immediate direction of the Garden is vested in a Director, appointed by the Board. The Garden receives no support from city or state but is maintained almost exclusively from the estate left by Henry Shaw. Since 1939 many Garden Clubs and interested individuals have contributed to a "Friends of the Garden Fund" which is used in developing the new Arboretum, located at Gray Summit, Mo. The Arboretum (1) serves as a source of plants, trees and shrubs for the city Garden; (2) affords areas for gradually establishing a pinetum, a wild-flower reservation and various other features on a scale not possible in the city; (3) provides greenhouses for some 20,000 orchid plants.

The city Garden comprises 75 acres, where about 12,000 species of plants are grown, both out of doors and under glass. It is open every day in the year except New Year's Day and Christmas; week days, 8:00 a. m. until sunset; Sundays, 10:00 a. m. until sunset. The greenhouses are closed every day at 5:00 p. m.

The main entrance to the Garden is at Tower Grove Avenue and Flora Place, on the Sarah car line (No. 42). The Tower Grove bus (No. 21), direct from downtown, passes within three blocks of the main entrance.

STAFF
OF THE MISSOURI BOTANICAL GARDEN

THE GARDEN, 2315 TOWER GROVE AVENUE, ST. LOUIS, MISSOURI

GEORGE T. MOORE,
Director

HERMANN VON SCHRENK,
Pathologist

EDGAR ANDERSON,
Geneticist

JESSE M. GREENMAN,
Curator of Herbarium

ROBERT E. WOODSON, JR.,
Assistant Curator of Herbarium

CARROLL W. DODGE,
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In charge of Succulents

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PAUL H. ALLEN,
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REPRESENTATIVE IN EUROPE

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by

Julian A. Steyermark

"A book that is complete. . . . Undoubtedly the book Missouri flower-lovers have been looking for."

Missouri Historical Review

". . . In short, the *Spring Flora of Missouri* is the best 'Spring Flora' available at present in the United States."

American Midland Naturalist

"Should be of great use to local garden clubs, and for the scientific worker who is concerned with the local flora it should be invaluable."

National Horticultural Magazine

"Carefully and critically done, so that it should find wide and enthusiastic reception at the hands of all who enjoy being acquainted with the rich native flora of Missouri."

Rhodora

"The most comprehensive spring flora ever issued for any state. . . . Notable for presenting its data in simple non-technical English, yet with thorough scientific accuracy. Book's value not limited to Missouri."

Field Museum Notes

For sale by the Missouri Botanical Garden. Price $3.00

MISSOURI BOTANICAL GARDEN BULLETIN

Vol. XXX MAY, 1942 No. 5

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OF THE MISSOURI BOTANICAL GARDEN

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1
TURKS CAP (*Melocactus matanzanus*)

2
SEEDLINGS OF TURKS CAPS (*Melocactus cactus*)
SHOWING LENGTH OF ROOT SYSTEM.

Missouri Botanical Garden Bulletin

Vol. XXX MAY, 1942 No. 5

TURKS CAPS ARE FOUND IN AMERICA

When Christopher Columbus discovered Puerto Rico in 1493, he stayed only long enough to replenish his water casks and take possession of the island in the name of Spain. He realized that the luxuriant island was not the spice kingdom for which he was searching, and he merely recorded his discovery on his chart and sailed on to other lands. Had he skirted the western coast for several more miles, he might have come upon some very curious cactus growths and would have been the first white man to see *Melocactus intortus*, now popularly known as "Turks Cap".

Fifteen years after the island's discovery, Ponce de Leon set out with a small band of followers from Santo Domingo to investigate the isle, "where a great spring of sparkling water flowed from the hills into the bay." The famous seeker of the source of eternal youth landed somewhere on the west coast of Puerto Rico, presumably a few miles below the original landing site of Columbus, or, as some claim, near Guánica on the southwestern coast, about twenty miles east of Cape Rojo. He found the natives quite friendly and explored the region for several miles inland. However, coming so poorly prepared as regards men and equipment, he did not establish a colony on the island until the following year (1509). Puerto Rico is only about 30 to 40 miles wide in the western extremity, and since Ponce de Leon explored that portion of the coast-line, it is surmised that his band of colonists was the first to behold the curious Melocactus which grows in such abundance in the arid southwestern portion of the island.

The Cactus family, to which the genus Melocactus belongs, is noted for its bizarre growths. No other group in the vegetable kingdom dares to boast such diversity. A glance at some of the descriptive common names that are pinned to cactus plants enables one to realize the wealth of fantastic material contained in this strictly American plant family. Dumpling, cane, serpent, living rock, hedgehog, barrel, torch, pincushion, old man, sea urchin, button, bishops cap, melon, twisted rib, golden ball, boxing glove, feather-ball, candelabrum, broadleaf, caterpillar, peanut, rattail, crab, and totem pole

give only a meager hint as to the great number of oddly shaped members of the family.

Of all the grotesque cactus mimics, the Melocacti are perhaps the most outstanding, resembling in form the brimless hats worn by Turkish men. Curiously enough, they were among the first to come to the attention of Europeans, because their island haunts had been discovered long before the mainland of America. Plants belonging to the genus Melocactus are characteristically globular to short-cylindric, with viciously armed ribs and topped with a peculiar head or cephalium. This cephalium is the fertile portion of the cactus from which flowers and fruits are produced. It varies in shape and size with the different species, sometimes being a small woolly cushion, sometimes a very large elongated structure twelve inches or more in length. The exterior portion is densely covered with white wool and reddish-brown bristles. The very tiny flowers seem much too small for the plant, averaging about an inch in length, including the ovary. The color ranges from delicate pink to deep rose to purple. The fruits, like the flowers, push their way through the dense cushion of wool and bristles and are more or less club-shaped, red to crimson or rarely white, much like those of Mammillaria. The prominent berries have a tasty acid flavor and are frequently eaten by the natives.

There are about two dozen known species of Melocactus. They are widely distributed in tropical America, being abundant on the Caribbean islands, the northern coast of South America and in portions of Mexico and Central America. Two species have been found in Peru and several in the desert regions of Brazil as far south as Rio de Janeiro. No species, however, has been located growing wild in the United States. Melocacti, as a rule, are found in well-exposed rocky places, and therefore require a lot of sun. Sometimes they grow in a grass country but very seldom in high bush.

In 1938 Mr. George M. Hotchkiss, who was in the employ of a Venezuelan iron mine, sent to the Garden several small plants of *Melocactus caesius*. These grew on a small hill, or rather an outcrop of highly mineralized rock, where a little water was possibly held in the rainy reason. It was noon when he discovered the plants, and then the rock was so hot he could hardly touch it. It is a mystery why such a succulent plant would choose so unfavorable a habitat, and yet a glance at the long root system may furnish an explanation (pl. 24, fig. 2). The seedlings sent were less than two inches in height, but their roots extended more than a foot into the small fissures of bare rock. Mr. Hotchkiss reported that the pinkish blossoms appeared suddenly in the evening and before next daybreak had closed again and were completely hidden in the fuzzy crowns.

Melocactus caesius apparently prefers the vicinity of the sea, for col-

lectors have noted its abundance along the bare rocky coast-line of northern South America and islands adjacent to it. The plants are more or less globose, about a foot or less in height, and possess between ten and fifteen strongly armed ribs. The cephalium or "Turks Cap" is composed of white wool and brownish bristles.

The true "Turks Cap" is *Melocactus intortus*, which, as mentioned before, grows plentifully in the desert region of southwestern Puerto Rico, in the vicinity of Cabo Rojo. Here rainfall is scarce and the sun beats down on the sparse vegetation with great intensity, but the Melocactus loves it. The species is also found on the Puerto Rican islands of Mona, Desecheo, Culebra and Vieques. It is more or less cylindric in form and may attain a height of twelve to sixteen inches. Its ridges are rather well pronounced and number fourteen in an average specimen. The spines are quite stout and vary as to number, color and size. There are usually seven or eight radials to an areole, the lower ones being by far the longest. On specimens that I have examined, there was one extra stout central spine and occasionally a supplementary pair in the upper portion of the areole. The cephalium is cylindric and on very old plants may be as long as the plant body itself. With its covering of wool and dense stands of reddish bristles, it is not hard to see why this plant has received the name of "Turks Cap". Its flowers are pinkish, the fruits crimson, and the seeds small and black, averaging fifty to a berry.

In 1939 Mr. Claud L. Horn, Associate Horticulturist of the Puerto Rico Experiment Station, located on the outskirts of Mayaguez, sent to the Garden a specimen of the "Turks Cap" from Mona Island, which to him appeared unlike the *Melocactus intortus* growing on the main island. When Dr. Britton visited Mona and Desecheo Islands in the Mona Passage, lying about midway between Hispaniola and Puerto Rico, he had observed a race of Melocacti with elongated slender spines, but since no other essential differences were noticed, he passed them on as forms of *M. intortus*. However, about 1932 Professor George F. Anton, of the College of Agriculture of the University of Puerto Rico, while collecting plants on Desecheo Island, observed slight floral and fruit differences in this species along with the elongated spines. He communicated these observations, with specimens, to Dr. Britton, who came to the conclusion that the plant was a distinct species and gave it the name of *Melocactus Antonii*. Perhaps, after all, this cactus may not deserve specific rank, but should be treated as a variety. It seems to be a much more robust and globose plant with slenderer spines that measure from one-half to two and one-half inches in length.

In most collections Melocacti are still quite rare, with the exception of those already mentioned, but seedlings of other species can now generally be procured from some of the dealers on the West Coast. The seedlings, how-

ever, do not exhibit the curious cephaliums until they are several years old. Several species are found in Cuba, the best of the small lot being *M. matanzanus* (pl. 24, fig. 1), a small globose cactus about three inches high, with a colorful small cushion at the top. Established plants require an abundance of light, good drainage, plenty of water during the summer months, and, as a rule, are not very hard to manage.

L. C.

FORMATIVE DAYS OF MR. SHAW'S GARDEN

It has long been known that Dr. George Engelmann had an important part in shaping the scope and direction of what ultimately became the Missouri Botanical Garden. Although Mr. Shaw consulted both Sir William Hooker, Director of the Royal Botanic Gardens, at Kew, England, and Dr. Asa Gray, Professor of Botany at Harvard University, it was Dr. Engelmann who, because of his scientific training and keen interest in botany, had the most to do with seeing that the proposed Missouri garden became a truly scientific institution.

George Engelmann was born at Frankfort-on-the-Main, February 2, 1809. At the University of Heidelberg he had as fellow students the botanists Karl Schimper and Alexander Braun. Later in Paris, while pursuing his medical and scientific studies, he had both Braun and Louis Agassiz as companions. In 1832 he was sent to this country by his uncles to investigate land investments in the Valley of the Mississippi. Joining relatives who had settled in Illinois not far from St. Louis, he made many journeys on horseback to southern Illinois, Missouri, and Arkansas. He thus became one of the earlier botanical explorers of this region. In 1835 he established himself in the practice of medicine at St. Louis, then a town of less than 10,000 inhabitants. By 1856 Engelmann's practice had become so thoroughly established that he was able to leave it for two years, devoting part of the time to botanical investigations at Harvard and later revisiting his native country.

Dr. Engelmann's published botanical papers exceed one hundred and much of his work is still regarded as fundamental. Present-day botanists owe much to his thorough investigations of such groups as the Cuscutae, North American Cactaceae, Yucca, Agave, Juncus, Euphorbia and many others. His various papers on the American Oaks and the Coniferae, published in the *Transactions of the St. Louis Academy of Science*, were the results of long-continued study. He also investigated the genus Vitus, the first paper being "The Grape Vines of Missouri". As a good example of the thorough way in which he worked, his notes on the grape are of a character

to interest the anatomist, the horticulturist, and the systematist. Included with the personal observations are notes from catalogues, extracts from articles, quotations from correspondence, comments upon blooming time and visitation of insects, drawings of leaves, internodes and seeds, lists of varieties, discussion of species characteristics, types of flowers and pollen, and much else. In addition to his published works, Dr. Engelmann accumulated, through a busy life as a physician, over sixty large volumes of notes on plants of all kinds. These are now in the library of the Missouri Botanical Garden.

Recently, some three- or four-hundred letters written by Engelmann to Asa Gray and now preserved at the Gray Herbarium of Harvard University were examined by Dr. Clarence E. Kobuski, of the Arnold Arboretum. Portions of these have thrown an interesting light on the early formative days of the Garden, indicating how the idea developed in the mind of Henry Shaw. For this reason they form an important contribution to the history of the Missouri Botanical Garden. The task of deciphering letters written over eighty years ago on thin paper with fading ink was no small one, and we are indebted to Dr. Kobuski for his assistance in making known to us the pertinent parts of the correspondence. In addition, the Garden has in its collection many letters of Asa Gray to George Engelmann. These have likewise been examined for references to Mr. Shaw or his garden. Unless otherwise indicated, all lettters are from Dr. George Engelmann to Prof. Asa Gray.

St. Louis, April 9, 1856.

"We have a very rich Englishman here, Shaw, an old resident and bachelor who concluded to devote his time and fortune to the founding of a Botanic Garden and Collection, Kew in miniature, I suppose. (He corresponds with Hooker.) I hope something valuable and permanent will come of it."

Cambridge, April 15, 1856.

"Bravo Shaw. I hope he will get a great many Western things growing in his garden." [Asa Gray to George Engelmann]

St. Louis, May 13, 1856.

"I have not yet seen much of Shaw, and am unfortunately not the proper person in address and diplomacy, etc., to work upon him—still I hope for the best; he seems very zealous. Get Hooker to encourage him! He has already had a letter from Hooker referring him to me! Which had a good effect."

Vienna, December 29, 1857.

"I spend a day at Leipzig to conclude the bargain with the heirs of the late Prof. Bernhardi about his large herbarium, said to include 40,000 (names

of) species, which I have obtained for our Mr. Shaw. I hope it will be a welcome acquisition for our country. I want books too, but S. is not easily persuaded, though Hooker does encourage him."

Florence, May 2, 1858.

"I believe I told you that I have bought Bernhardi's Collection for Shaw; I have since bought for him a number of botanical works selected by him, some valuable ones amongst the number. He writes me that he has sent you a plan for his Gardens—rather stiff, it seems to me, and antiquated. I hope you answered him encouraging him in general, and giving good advice."

St. Louis, September 28, 1858.

"Mr. Shaw is very busy preparing his Botanical Garden; he has built a fine stone wall around 10 acres of fine, slightly sloping ground; prepared 'cystern' wells, drainage, etc., etc.; is building a greenhouse of considerable dimensions (he has already several small ones)—the Garden itself is really empty yet. He builds a fine entrance, porter's or guardian's lodge, etc.—I suppose in imitation of English parks; he is puzzled about the superscription, which I found was *Hort. Bot. Missouriensis.* I advised him to have it in English, *Missouri Botanical Garden*, as less 'pedantic' and not to abbreviate the principal words.—You see how trifles occupy him (and us!).—

"He has also prepared his plans for a Museum, Library and Herbarium; of course, according to the Kew plan—but unfortunately he has had the plan of the *old* Museum only, and worked and planned on that!—the rooms, 1 for Library, the 2 for Herbarium, are too small, and there is no working room in the whole building if it be not the basement.

"He is much obliged to you for the Australian seeds.—

"The building is to be one large hall with galleries, and two smaller rooms one above the other, attached to it—these are the Herb. and Libr.;—a basement under the whole.—"

Cambridge, October 14, 1858.

"I rejoice to hear that Mr. Shaw keeps up his zeal, and will make a creditable establishment. I wish him all prosperity. If he will make and keep up a general herbarium it will save you much time and money . . ."

[A. G. to G. E.]

St. Louis, October 30, 1858.

". . . Shaw's herbarium has also arrived (in Washington). Fendler, with his sense of neatness and order, would be a capital Curator and could be spared occasionally for excursions to Utah, etc., but I do not know whether Shaw would enter into such a plan. I must be very cautious in approaching him. The herbarium to him is a very secondary thing to the Garden."

Cambridge, November 8, 1858.

"A good idea for Fendler—to make him a Curator—if Mr. Shaw will do

it. If not now will he pay him a decent sum to have him collect rare living plants & seeds—in the far west for Hortus Missouriensis? . . . .

"What say you to Shaw's buying *Fendler's own set* of Venezuela plants complete* in place of the one you have, & which I could probably dispose of?" [A. G. to G. E.]

Cambridge, December 3, 1858.

"Wright has gone to Cuba. When Shaw takes these collections, please pay Fendler the amount of Wright's Cubans—$61.80 instead of remitting to me." [A. G. to G. E.]

Cambridge, January 7, 1859.

"Messrs. Rice & Kendall, Water St., Boston, are the persons with whom I have contracted for paper, both herbarium species paper & genus covers. Both, I have made to special order—and a good large lot at a time, in order to make them do it on reasonable terms. Mr. Shaw may refer them to me, for the patterns of the article wanted (if he takes my size and quality), or, under his instructions I will get their terms, and order for him." [A. G. to G. E.]

[*St. Louis*], *February 25, 1859.*

"Shaw is laying the foundation of his Library and Museum (à la Kew) and Herbarium now—it will be under roof probably late in the fall. Before that time the herbarium can not be opened nor any attempt at arrangement be made. He is also very industrious in getting the preparations for his Garden of 10 acres, arboretum besides.

"The paper to be sent to Henry Shaw, St. Louis, Mo.; the manufacturer to draw on him as soon as shipped (by the cheapest way, probably New Orleans). When can it be sent? . . . . The quality to be the same as yours, of which I took a pattern with me. I suppose with this large quantity—some for yourself added to it—it will be done at reasonable rates."

St. Louis, April 15, 1859.

"Shaw is busy; I do not know how he progresses, but he is energetic and business-like—would he had more scientific education or taste! My practice leaves me only a few hours a day to other things so that I can find no leisure to go out and see his place and improvement which is as far from here as your Garden is from Boston."

Cambridge, April 23, 1859.

"I am now going soon to order your Herb. paper. I shall get it in a few weeks after ordering. The longer it lies before using the firmer it becomes & better.

"But—as it is always a bother and difficult to match what we have once got, let me suggest to Mr. Shaw to order *more*. 12 reams genus covers will

*Minus orchids which go to Lindley.

do very well, but 24 reams of plant,—practically about 11000 sheets—you will very soon use up." [A. G. to G. E.]

St. Louis, May 13, 1859.

"Shaw wants to construct a kind of charter, last will, donation or something of the kind for his establishment; his lawyer, ..., will shortly go East and also call on you to get your views about the arrangements of the whole concern.

"I was disappointed in the annual income of the establishment; for the first 20 years it will not have more than $10,000 annually with which to pay the Curator, the Gardeners; keep up and increase the Garden, Herbarium and Library.— After 20 years—i.e., after us, the income (from rents) will be much larger.— It is to be hoped that Shaw will live long yet, so as to expend larger sums at least for the arrangement of Garden, foundation, and increase of Museum, Herbarium, and Library.—"

Cambridge, May 16, 1859.

"I send you Bentham's letter, wanting to find a purchaser for a set of Spruce's Amazon plants. . . . . It is just possible that Shaw might take a fancy to the collection, but I do not expect it, nor care to have you send him Bentham's letter, unless you think he would like to have at least the offer." [A. G. to G. E.]

Cambridge, May 18, 1859.

"Well, even $10,000 a year is much better than nothing for the botanical establishment. I wish we had half of that.

"I will do anything I can in the way of affording information to Shaw's lawyer when he comes. You had best indoctrinate me beforehand with any views which you yourself think important.

"Now, I *will order the herbarium paper*, and increase your portion as requested.

"If Shaw will be liberal in his establishment, why not turn over to him your general herbarium? If I had one I could have free access to always, I would not take the expense and trouble of keeping up and increasing one myself . . ." [A. G. to G. E.]

St. Louis, June 2, 1859.

"Shaw is liberal enough, to be sure, but then, with an income of $75,000 (it is said) and no family, he might do more than give 10,000 annually for his Botanical Garden; it would be a great deal for the *Garden* but that amount must pay all the personages—Curator, Gardener, assistants, etc.,—increase Library and Herbarium. I should like him to buy Fendler's plants and engage F. for Herbarium and Library, especially as F. now finds out he has been too hasty in his gas-distilling enterprise;—but for the present time

there is no probability of his doing anything of the kind till his 'Museum' is built up, which is now up to the first story, will be done next year."

Cambridge, June 6, 1859.

"Shaw is *very liberal* to give $10,000 out of an income of 75,000—perhaps he will do more when he gets under way. Surely he ought to take Fendler's collections—& secure him as curator. It is his *very place.*

"As to your own herbarium, I think you are right for the present. Keep your own; arrange it on paper of the size of Shaw's. But look to an eventual combination, either in Shaw's lifetime or soon after, and be open to propositions from Shaw; as, for example, to take your whole herbarium, provide for maintenance and increase, and when ready, to make you director of the whole concern. This duty must devolve upon you, and when it does, with a decent salary, you could reside up there, throw physic to the dogs, or only take a share in consultations, and have time to do yourself justice in botany.

"Meanwhile, if Shaw would take your herbarium upon proper terms, you might at any time have any particular families of plants with you, in your house, to work at . . ." [A. G. to G. E.]

St. Louis, June 15, 1859.

"Let him first build his Museum then he will unpack his Herbarium, put up his Library, etc., and will find it necessary to employ a Curator; Fendler must keep quiet and ready till then.

"I shall do with my Herb. as you advise—indeed half of the paper ordered, or more, is for me; I intend to have it in the same style as Shaw's so that at a future time they can be united.

"I am thinking much about it whether I should undertake the directorship of such an establishment with all the cares and duties; but there will be years yet before such a thing can be accomplished."

Cambridge, July 20, 1859.

"Your herbarium paper is done, and by this time shipped to St. Louis, and advised to Mr. Shaw, as instructed." [A. G. to G. E.]

St. Louis, August 3, 1859.

"Shaw is only commencing—it can not be called a garden yet, not worth while to send him seeds yet. He got a lot of hothouse plants of value from Germany.

"I should long to be doing something in house botany in his Garden—Aster, Helianth., Desmod., etc., etc., but do not see that I ever shall have the leisure, or that I can agree with him, though I am on a very good footing with him. I am not practical and don't know [how] to use him.

"He is building his Museum, but whether he will employ Fendler, when it is done, is doubtful. I am a little discouraged about the whole thing."

Cambridge, August 8, 1859.

"Mr. Shaw has lately written. I enclose his letter to you. I have just replied to it, expressing a lively interest in his projected establishment, and offering my best services, if he requires them, in the way of advice or suggestion. I hope it will be all right in the end. . ." [A. G. to G. E.]

St. Louis, October 17, 1859.

"Shaw is busy getting greenhouses in order before winter. He continues zealous, but unfortunately does not know enough and is in many things a little narrow minded."

St. Louis, date lacking.

"I saw a long and very good letter of yours to Shaw. S. continuing zealous as ever, is making his will now, preparatory to turning over the whole to trustees; but he is much better yet at the head himself as he not only carries things on more energetically but also with more means than the trustees would have on hand."

St. Louis, December 30, 1859.

"As for me, I do not see much improvement in the near future for my botanical prospects. My professional labors increase; the income they bring me is necessary for me to live on, but not large enough yet to make me independent; as to a possibility to connect myself with the Missouri Bot. Garden in a permanent way, I do not see my way yet before me, and must bide the time."

Cambridge, March 20, 1860.

"Would it do for me to write to him and recommend him to employ Fendler—send him out to California to botanise for a year or two & then be curator to his herbarium?" [A. G. to G. E.]

St. Louis, April 10, 1860.

"He is as tough as any Scotchman, and I fear for the present he won't buy any more books; but as to Fendler, I shall have to speak to him as the season is advancing. I am afraid that it will be no go. As I suggested to him the other day to devote annually $1000 for increase of Library and half as much for Herbarium, he laughed at such a preposterous idea—his Museum, he said, cost him (building and arrangements) 25,000 and he had nothing yet to fill it, etc.

"I am afraid we can not pull well together—I can not influence him. I do not understand the soft soaping as the western phrase is;—a man who has no real scientific zeal nor knowledge who must be got to do things by diplomacy, I can not do much with. The proper way would be to get him interested in what interests us and seems important to us, but that I unfortunately do not understand.

"Fendler is undecided what to do."

St. Louis, June 12, 1860.

"Shaw is working ahead but I do not see much of him; we are very good friends but I am afraid would not hitch well together. Scientific botany is secondary or tertiary with him, while I can not get up an enthusiasm for what interests him most."

St. Louis, October 4, 1860.

"I think that Shaw will now give Fendler a berth; he has almost finished his Museum and will open his Herbarium (Bernhardi's) bought by me 3 years ago in Leipzig; Fendler is to put everything in order. If once he got a foothold there I hope Shaw will find his services useful in many ways."

[*Cambridge*], *October 11, 1860.*

"From what I know of Dr. Lindley's way of illustrating lectures, and of putting up microscopical illustrations, I should say that the collection on sale is very important for the purpose, and that Mr. Shaw might do well to secure it.

"I am glad that Mr. Shaw will secure the services of Fendler for his herbarium." [A. G. to G. E.]

St. Louis, November 1, 1860.

"Shaw is going on slowly, but still going on. He has the ornamental as much at heart as the scientific, which I think is very well to popularize his establishment. Times, unfortunately, do not permit him to spend any money on herbarium or library, which is unfortunate, but we must take what he is willing to do and to give. He has erected in a grove a very pretty though plain cenotaph for Nuttall. I wanted him to put his bust up—but he declined. Is there one, or a portrait in existence? By and by he will get Hooker's & R. Brown's busts."

Cambridge, August 6, 1861.

"Dr. Hooker sent me last spring a fine cast of a bust of Robert Brown. To-day I have also from him a splendid one of his father, Sir William. Tell Fendler that Mr. Shaw should procure both if possible for the Library of Hort. Bot. Missouri." [A. G. to G. E.]

St. Louis, August 17, 1861.

"It is not at all impossible that St. Louis in the West will be, what Washington is in the East, the great prize to be fought for, and only think the honor, many imagine, that the Missouri Bot. Garden, with its substantial buildings and the long and solid walls surrounding it, situated on an elevation in a large cultivated plain, can not fail to be the principal Battlefield!!

"No jesting about it."

St. Louis, September 12, 1862.

"I have seen in Hort. Bot. Missouri *Pectis angustifolia*—strong lemon-peel fragrance . . . .

"I have re-examined *Pentstemon barbatus* in Hort. Shaw . . . ."
St. Louis, October 8, 1862.

"I have compared Hooker's original figure in Shaw's coll. . . ."
Cambridge, November 21, 1862.

"See if Shaw will buy up a lot of Parry's Coniferae seed." [A.G.to G.E.]
St. Louis, July 6, 1864.

"I am sorry to learn from Fendler, that he is not going to help you; and I am afraid that Mr. Shaw will not employ him again—I am sure that Fendler for the present prefers the wild woods—he writes quite poetically about his woodland house—a very primitive one at that."
St. Louis, June 5, 1865.

"Whether Fendler will come I can't tell. Shaw says he attended very little to the Garden; but he seems fond of gardening. Entre nous:—he is not as young as he was 15 years ago, and seems to me to feel the 50 years as much as I do or more! He was here the other day and said he expected a letter from you. He seems undecided—wedded to his little farm and feeling as if he could not well leave his brother who is a helpless fellow."
Cambridge, January 29, 1866.

"Ah, you did miss it by not replying to Short's letter. I told him to offer his Herbarium to Shaw, if you approved it. But I never knew before that he did." [A. G. to G. E.]
St. Louis, March 3, 1866.

"That affair about Short's Herbarium was a little complicated. He offered through me his Herb. & Library to Shaw but in such a manner that I thought he wanted to sell—Shaw thought he had already many of the books and plants and would not go into the expense; so I hesitated, and felt bad about it—and at last did not answer. I ought to have consulted you!"
Cambridge, March 20, 1866.

"Of course Short meant to *give* his herbarium." [A. G. to G. E.]
Cambridge, April 8, 1867.

"There are some seeds from Kew—of shrubs & trees—which I do not need—Shall I send them on for Mr. Shaw—with whatever may be for you?" [A. G. to G. E.]
Cambridge, April 22, 1867.

"I will send you all your things . . . . by express, & put with them packages of seed from Kew & Australia for Hort. Bot. Miss. for which Mr. Shaw should pay the expense of the package." [A. G. to G. E.]
Cambridge, April 27, 1867.

"I had sent the *seeds* in the package for you.

"No matter.—Only I wish Shaw would have somebody get seeds in quantity—to send to Müller for the Melbourne Gardens." [A. G. to G. E.]

Cambridge, December 24, 1873.

"You asked for 20 *reams of genus paper* . . . . But I have now a bill sent me for '30 reams' . . . . Will Shaw share with you, and cover the whole?" [A. G. to G. E.]

Cambridge, February 28, 1875.

"When Shaw dies—go up & take charge of the establishment—make them give a good [salary] and provide a good assistant, as well as gardener." [A. G. to G. E.]

St. Louis, March 7, 1875.

"You want me to take Shaw's place after his death—I am twenty years too old for that—The complicated affairs of the management would bear me down, No— And, besides, I feel so rusted in my profession, that I do not feel contented outside of the bustling, ever-varying life of a physician and its excitement. And then—I should not like to separate from George [his son who is also a physician] and also from the city, and live 4 miles out in the country."

Cambridge, May 20, 1878.

". . . . That enlarged photograph* is for you, to be left for your St. Louis Academy of Sciences, if it gets ever a home, or for the Hortus Botanicus Missou.iensis, as you elect. Glad you value it." [A. G. to G. E.]

Asa Gray to J. D. Hooker—Cambridge, June 9, 1884.

"You remember Henry Shaw, his park and Missouri Botanic Garden. The old fellow is now eighty-four. Something induced him to ask my advice, and to let me know the very ample fortune with which he is to endow the Garden, when he dies. I was in doubt whether all this was likely to be quite wasted, or was in condition to be turned to good account for botany and horticulture when Mr. Shaw leaves it and his trust comes to be executed. I wished also to see that dear old Engelmann's herbarium should be properly and permanently preserved. So I went on to St. Louis. Mr. Shaw took me into his counsel and, without going here into details, without seeing a chance for doing much while Mr. Shaw lives, which cannot be very long, I see there is a grand opportunity coming, and I think that none of the provisions he has made will hinder the right development of the Mississippian Kew, which will hardly be 'Kew in a corner.' And if he follows my advice and mends some matters, there will be a grand foundation laid."

Asa Gray to J. D. Hooker—City of Mexico, Sunday, February 22, 1885.

"Your letter of January 20, forwarded from Cambridge, overtook us at San Antonio, Bexar. We left home February 3, in bitter cold, for St. Louis,

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*Photograph of camp on Rocky Mountains, La Veta Pass, with the best photographic likenesses, perhaps, ever taken of Sir J. D. Hooker and Dr. Gray; and including General and Mrs. Strachey, Dr. Hayden, and Captain Stevenson.

where I had an interview with old Shaw, and heard him read his rearranged will, which is satisfactory, as it will allow his trustees, and the corporation of Washington University there, to turn his bequests to good account for botany; will be an endowment quite large enough for the purpose."

England, June 17, 1888.

"My Dear Mr. Shaw:—

"I have just received your most handsome present of Engelman's Botanical Works, edited by our dear late friend, Dr. Gray, and I do thank you most heartily, no less for your kind gift than for the effective service to botany that this most valuable contribution to the science renders. It is indeed a noble tribute to a man whose labors as a most conscientious and painstaking botanist have never been surpassed, and I prize it for the sake of the man whom I knew so well and esteemed so highly. I shall never forget my visit to him and to you and the afternoon I spent in your garden and museum at St. Louis, in company with Dr. and Mrs. Gray.

"I have been most interested in all that Dr. Gray told me last year about the noble botanical institution that you have founded and in his hopes that it would be a center of diffusion of knowledge, the influence of which would be felt far and wide.

"I think that he was more proud of your consulting him in the matter of its organization than of any of the many services which he had rendered to American botany, and he certainly regarded his labor with you as the most pleasant episode of his later years and by far the most important.

"Believe me, my dear sir, most faithfully and gratefully yours,

"Joseph D. Hooker."

VERONICA HEDERAEFOLIA IN MISSOURI

On April 16 I found a considerable number of these inconspicuous little speedwells growing on a moist shady bank in the grounds of the Sebago Club in St. Louis County. So far as is known, this is the first report of the species from Missouri. Pennell, in his monograph "The Scrophulariaceae of Eastern Temperate North America," gives its distribution as "low woodlands, New York to Ohio and North Carolina; locally abundant. Naturalized from Eurasia." There is in the herbarium of the Missouri Botanical Garden a specimen collected by Bassett Maguire in Cache Co., Utah, in 1932, so the species is apparently continuing to spread. It is an innocuous little winter annual and shows no sign of becoming a dangerous weed.

E. A.

NOTES

Mr. George H. Pring, Superintendent of the Garden, spoke before the Rotary Club of University City, May 4, on "Romance of the Plant World."

Dr. David C. Fairburn, Horticulturist to the Garden, gave a talk to the Nurses of the Private Duty Section or Special Nurse Group, May 7, on "The Care of House Plants."

The article on "Tropical Waterlilies" by Mr. G. H. Pring, in the March 1941 Garden BULLETIN, has been reprinted in the April number of *Home Gardening* (**2**:148-149, 156-157).

The April number of the *Missouri Historical Review* contains a notice of two of the Garden publications: "Henry Shaw, A Biography;" and "A Tour of the Missouri Botanical Garden."

Dr. Edgar Anderson, Geneticist to the Garden, participated in the annual Nature Tour held under the auspices of the Illinois Department of Parks at Starved Rock State Park, Ill., April 25-26.

Dr. George T. Moore, Director of the Garden, spoke before the Kiwanis Club of University City, April 21, on "Gardens and Gardening", and before the Southwest Kiwanis Club, April 22, on "Henry Shaw and His Garden."

Recent visitors to the Garden include: Dr. John T. Buchholz, professor of botany, University of Illinois, Urbana; Dr. Christianna Smith, professor of biology, Mt. Holyoke College, South Hadley, Mass.; Mr. William L. Brown, Cytogeneticist, U. S. Golf Association, Green Section, Washington, D. C.; Mr. Mulford B. Foster, Bromeliad specialist and plant collector, of Orlando, Florida.

The second number of Volume XXIX of the ANNALS OF THE MISSOURI BOTANICAL GARDEN was issued in April, with contents as follows: "Contributions to Our Knowledge of American Carboniferous Floras. III. Stipitopteris," L. Wayne Lenz; "Races of *Zea Mays:* Their Recognition and Classification," Edgar Anderson and Hugh C. Cutler; "Dolomitic Glades of East-Central Missouri," Ralph O. Erickson, Louis G. Brenner and Joseph Wraight; "The Environmental Variables of the Missouri Botanical Garden Wildflower Reservation at Gray Summit," Louis G. Brenner; "Helminthosporium Spot of Citronella and Lemon Grass in Guatemala," Carroll William Dodge.

STATISTICAL INFORMATION FOR APRIL, 1942

GARDEN ATTENDANCE:	
Total number of visitors	23,885
PLANT ACCESSIONS:	
Total number of plants and seed packets received as gifts	3,805
LIBRARY ACCESSIONS:	
Total number of books and pamphlets bought	26
Total number of books and pamphlets donated	286
HERBARIUM ACCESSIONS:	
By Purchase—	
Stanford, L. R.—Plants of Mexico	1,112
By Gift—	
Anderson, Edgar—*Prunus nigra* Ait. of horticulture	1
Boyd, Mrs. A. Shapleigh—*Monotropsis odorata* Ell. of North Carolina	1
Cory, V. L.—Plants of Texas	2
Cronquist, Arthur—Plants of Idaho	70
Darker, G. D.—Fungi of Missouri, Massachusetts, Ontario, New Hampshire, and Colorado	32
Harper, Roland M.—Photographs and Plants of Alabama	96
James, Leslie—Plants of Alabama	12
Lenz, L. W.—Plants of Montana	2
Meyer, Frederick G.—Plants of Washington, Oregon, Idaho, California, and British Columbia	4,000
Penland, C. William T.—Plants of Colorado and Peru	43
von Schrenk, Hermann—*Prunus Armeniaca* L. of horticulture	1
By Exchange—	
State University of Iowa—Plants of Iowa	218
Total	5,590

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OF THE MISSOURI BOTANICAL GARDEN

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Field Museum Notes

For sale by the Missouri Botanical Garden. Price $3.00

MISSOURI BOTANICAL GARDEN BULLETIN

Vol. XXX JUNE, 1942 No. 6

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SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date until his death in 1889 it was maintained under his personal direction. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was chosen by Mr. Shaw and he definitely indicated that he wished it called by that name. The Garden passed at his death into the hands of a Board of Trustees, designated in Mr. Shaw's will, and the Board so constituted, exclusive of certain ex-officio members, is self perpetuating. By a further provision of the will the immediate direction of the Garden is vested in a Director, appointed by the Board. The Garden receives no support from city or state but is maintained almost exclusively from the estate left by Henry Shaw. Since 1939 many Garden Clubs and interested individuals have contributed to a "Friends of the Garden Fund" which is used in developing the new Arboretum, located at Gray Summit, Mo. The Arboretum (1) serves as a source of plants, trees and shrubs for the city Garden; (2) affords areas for gradually establishing a pinetum, a wild-flower reservation and various other features on a scale not possible in the city; (3) provides greenhouses for some 20,000 orchid plants.

The city Garden comprises 75 acres, where about 12,000 species of plants are grown, both out of doors and under glass. It is open every day in the year except New Year's Day and Christmas; week days, 8:00 a. m. until sunset; Sundays, 10:00 a. m. until sunset. The greenhouses are closed every day at 5:00 p. m.

The main entrance to the Garden is at Tower Grove Avenue and Flora Place, on the Sarah car line (No. 42). The Tower Grove bus (No. 21), direct from downtown, passes within three blocks of the main entrance.

A TYPICAL COLONY OF *APOCYNUM CANNABINUM*, GROWING NEAR CARONDELET, MISSOURI.

Missouri Botanical Garden Bulletin

Vol. XXX JUNE, 1942 No. 6

PLANTS TO MEET THE WAR EMERGENCY

The war in which we are now engaged seriously interferes with the regular channels which supply raw material for industry. Sources long depended upon are no longer available and substitutes of all kinds are being investigated in the hope that much-needed articles may still be had.

From the beginning of time plants have contributed much to the needs of man. Quite apart from their use as food, drugs, and shelter, plant products have increasingly had a share in adding to the comfort and welfare of civilized communities. In spite of the developments in chemistry and physics, the vegetable kingdom must still be depended upon to furnish basic substances that the plant manufactures better than any laboratory or factory. The economic botanist has long had knowledge of the many valuable properties of plants, some used, many ignored or neglected in the technical world.

Because certain countries have had natural advantages of climate and labor they have furnished us with important plant products, but as these countries are no longer a source of supply a reëxamination of the resources of the plant kingdom is in order. The manufacturer is apt to obtain his raw material from the cheapest market even though as good or better material can be had nearer home. In times like these he will pay practically any price but as soon as the old source is again available, he is almost certain to return to it regardless of what effort may have been made to supply his needs during the emergency. There are many vegetable fibres and plants with milky juices which, so far as the original product is concerned, are fully capable of meeting any demands made by industry. Money and time for solving technical difficulties are needed, of course, but even more important is opportunity for the plant breeder to bring to the highest state of perfection both the quality and quantity of the desired product. Notable examples of achievement are to be found in the Dutch East Indies in the development of rubber and quinine. That more has not been done is partially due to the fact that, even were an immediate market available, experience has shown that there is no likelihood of its permanence. Not

only in the United States, but in Central and South America, there are now in existence natural sources of plant material which could rapidly be developed were there any assurance that the whole enterprise would not collapse as soon as the war is over.

The vegetable kingdom has been lavish in its production of products useful to man. It would seem that a more intelligent use of Nature's gifts might be expected, at least that man would be willing to recognize his dependence upon the plant world and to acknowledge it accordingly.

RUBBER

Almost 98 per cent of America's former supply of rubber has come from the Far East. Yet the tree which produces it is a native of Brazil, its scientific name being *Hevea brasiliensis*, and its popular name "Para rubber tree." Like the pineapple, the quinine tree, and other economic plants native to the New World, the Para rubber tree was transplanted to the Orient where it flourished and soon furnished the chief source of supply.

In 1876, an Englishman named Henry A. Wickham brought about 70,000 seeds of the Para rubber tree from Brazil to England. Seedlings were grown from them in the nurseries of the Royal Botanic Gardens at Kew, and the 2,700 that developed were shipped to Ceylon whence they were distributed throughout the eastern empires of Great Britain and the Netherlands. Cheap and intelligent Oriental labor and the rapid development of the American automobile took charge of events from there on.

We may read the downfall of the Amazon Valley and the unconditional triumph of Malaya in the following figures gathered by the Bureau of Foreign and Domestic Commerce, U. S. Department of Commerce. During the period 1900-1904, the Far East contributed less than 1,000 long tons of the world's rubber, while the Amazon Valley contributed over 29,000 long tons. In the next decade, from 1910-1914, however, the Far East jumped to 38,000 and Amazonia fell slightly behind with about 37,000 long tons. During World War I, and immediately after, the American automobile became the common property of the man in the street, and tires, plus the discovery of new uses for rubber in every phase of daily life, gave a tremendous impetus to rubber consumption. But Malaya was the chief beneficiary, and Amazonia continued to lose ground. In the period of 1915-1919, the Orient produced about 206,000 of long tons and the Amazon Valley only about 31,000. By 1941, for the first ten months only, the account stood at over 1,204,000 long tons for the Far East to not quite 17,000 for Brazil. Previous to 1941 the United States alone consumed more than 50 per cent of the entire world's rubber supply; therefore we, of all people, shall feel its loss most keenly.

During the first World War, 1914-18, fresh plantings of Para rubber were made in various parts of the American tropics, and many additional sources of latex were discovered in several groups of native plants. Promising experiments on their cultivation and use were begun, but, with the return of peace, back we went to the former sources of supply.

Now we are again in need of convenient sources of many important commodities previously supplied from abroad, and of all these by far the most vital is rubber. The Government has taken a number of important steps to relieve this shortage, but they are only *steps* as yet. The cultivation of *Hevea brasiliensis* in our own tropics has been resumed with almost feverish intensity, but tapping for rubber cannot be done successfully until the trees are five to seven years of age.

Synthetic rubber is possible in a highly developed industrial country such as ours. But synthetic rubber is rubber in name only. Although some of its properties and uses are similar to the natural product, it does not have the inherent pliability and lasting qualities. The construction of apparatus for the production of over 500,000 long tons of synthetic rubber, which was the approximate annual consumption of rubber before December 7, 1941, would require a tremendous outlay of money (the Government's estimate exceeds a billion dollars), not to consider the loss of machinery and man power that otherwise might be devoted more directly to the war effort. Also, the cost of synthetic rubber per pound, besides the initial expense for apparatus, probably would be about twice the average cost of Para rubber. Even at this high cost, facilities for such a tremendous supply of synthetic rubber could not be completed in less than two to four years, and their use would become prohibitive at the close of the emergency.

What, then, of the sources of natural rubber, other than Hevea, which were discovered in our own country before and during the last World War, and what are the possibilities for their use now? Nearly seventy plants native to the United States have been found to contain rubber, some in considerable quantities. Of these, the four most promising appear to be the following:

GUAYULE *(Parthenium argentatum)*.—In the last few months, guayule has made many headlines in newspapers. This plant is a member of the Compositae, the Daisy family. It is a low, bushy undershrub seldom taller than three feet, with closely branched stems about as thick as a pencil, closely set grayish leaves up to an inch and a half long, and long-stalked heads of tiny pale yellowish flowers somewhat like the heads of the familiar bachelor's buttons. Guayule is a plant of the deserts of northern Mexico and the border counties of our own southwestern states, where it is

found in company with such plants as sage-brush, greasewood, yucca, and agave.

The rubber in guayule comes from cells of the inner bark and pith of the stems and roots. Associated with these cells are resin canals which also contain some rubber. Since the rubber occurs largely in separate cells, the guayule cannot be "tapped" or drained from a cut in the bark as are Hevea rubber trees. The whole plant, or at least the whole stem, must be ground in a mill and the rubber separated from the pulpy residue. When extracted in this way, the yield of rubber for the whole plant is about 9.5 per cent, a very favorable showing.

The method of grinding guayule in a mill in order to extract the rubber harks back to the discovery of the elastic property of the plant. About the middle of the eighteenth century, we are told, a Jesuit named Negrete noticed some Mexican boys playing with an elastic ball that they had obtained by chewing the plant which we now know as guayule. Reference to similar balls by much earlier writers in Mexico indicates that extraction of rubber by chewing the plants probably antedates the Spanish conquest.

In the same year that seed of Para rubber were sent to England from Brazil, an exhibit of the rubber of guayule was sent from Mexico to the Centennial Exposition at Philadelphia. Nearly thirty years later a small quantity of this rubber was put on the market by a Mexican company under German control, and later the Continental Mexican Rubber Company was formed at Torreon. In 1909 a small guayule factory was established at Marathon, Texas, but this went out of business when the native supply of guayule plants was exhausted. By 1911 it was estimated that the investment of American capital in guayule in Mexico alone amounted to $30,000,000, with an annual export value of $10,000,000.

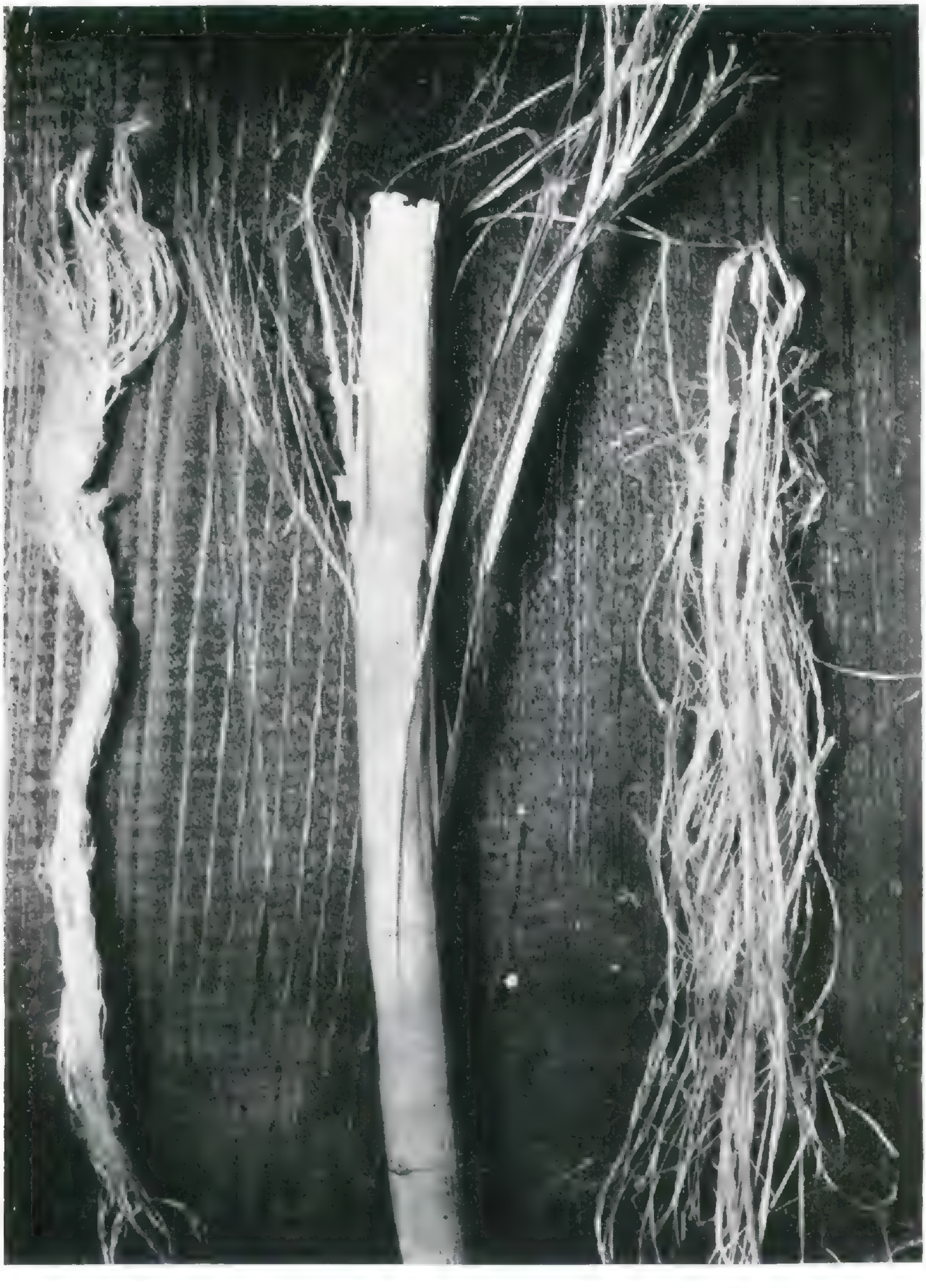
Although Mexico has continued to produce and use guayule rubber, it has been more or less of a curiosity on the United States market. A small experimental plant built by the American Rubber Producers, Inc., at Salinas, California, has not been a financial success, partially due to the impossibility of competing with the price of Asiatic rubber, together with certain manufacturing difficulties. With the advent of the present shortage of rubber, conditions have changed somewhat. The promoters of guayule assert that it is an ideal defense plant, needing no vital chemicals for processing and requiring no excessive man power. It is estimated that one man can take care of an acreage sufficient to produce 25,000 pounds of rubber annually. Federal legislation contemplates the purchase of the factory at Salinas, involving 75,000 acres of guayule—enough, it is thought, to produce nearly 60,000 long tons of rubber annually.

RABBIT-BRUSH *(Chrysothamnus nauseosus)*.—One of the commonest plants associated with the sage-brush on the deserts of the Great Basin of western United States is rabbit-brush *(Chrysothamnus nauseosus)*. This is a grayish shrub from two to eight feet tall, with small leaves and heads of yellow flowers somewhat resembling goldenrod. Like guayule, it is a member of the Daisy family. Shortly after the turn of the present century, investigations of the possibility of rabbit-brush as a source of rubber were undertaken, and in 1908 a small rubber extraction factory was projected at Salida, Colorado, but the plans fell through.

With the entry of the United States into the first World War, our dependence upon foreign rubber was realized, and Dr. H. M. Hall and Dr. T. H. Goodspeed, of the University of California, investigated the possibilities of rabbit-brush. They found that it would yield from 2 to 3 per cent of a good grade of rubber, which they named "Chrysil". Natural resources were estimated to produce something more than 80,000 tons of rubber, but with the end of the war the work was abandoned. The relative merits of rabbit-brush and guayule were found by Drs. Hall and Goodspeed to be about as follows: Thanks to the pioneer work done with guayule in Mexico, the essential methods of field management, milling and marketing were fairly well established, and the yield of rubber from this plant is three or four times greater than from rabbit-brush. However, the much larger size of the rabbit-brush plant produced a greater yield per acre than guayule in spite of the smaller percentage of rubber. Rabbit-brush seems to be easier to propagate and is more tolerant of environmental conditions than is guayule.

MILKWEED *(Asclepias spp.)* and DOGBANE *(Apocynum spp.)*.—Some years after his experiments with rabbit-brush, Dr. Hall again took up the study of native rubber plants with the assistance of his colleague, Dr. F. L. Long. This time the chief objects of interest were species of milkweed (Asclepias) and dogbane (Apocynum). Both of these common plants, which are perennial herbs, produce an appreciable amount of the milky juice from which rubber is made. Milkweed and dogbane are considered together because they have so much in common. While belonging to different plant families, their biological nature is much the same, as is the quality of rubber obtained from them, and both furnish important by-products calculated to make their use more profitable.

There are many species of milkweed and dogbane native to the United States, and their distribution is country-wide. Unlike guayule and rabbit-brush, which are confined to very restricted areas of the United States, milkweed and dogbane are more capable of being regarded as the source of a nation-wide industry than perhaps any other agricultural crop. The amount



STEMS OF *ASCLEPIAS INCARNATA*

Left—fiber bundles removed from stem.
Center—section of mature stem showing cortex fiber bundles.
Right—removed fiber bundles after boiling in weak alkali.

of rubber varies according to the species. Thus, *Asclepias subulata*, a plant of the southwestern deserts, yields from 2 to 6½ per cent, while *Asclepias syriaca*, the common milkweed of the northeastern states, contains from 1 to 4½ per cent. The common dogbane *(Apocynum cannabinum)*, which occurs in practically every state in the Union, has a yield of from 1 to 5 per cent of rubber. The variation in percentage is due to the fact that the wild plants have not been subjected to selective breeding and cultivation, and the rubber content might easily be expected to be standardized, if not increased, by improved growing practices. The quality of rubber obtained from milkweed and dogbane is not quite as good as that from guayule and rabbit-brush, but it has been suggested that it would be ideal for mixing with other rubbers as well as in manufacturing products where great elasticity is not required.

In addition to the wide climatic tolerance of these two plants, an important consideration is the ease with which they can be grown. Both plants produce runners or root shoots beneath the ground which ultimately produce new plants. So profuse is this method of vegetative propagation that many milkweeds and dogbanes are objectionable weeds in cultivated land. This habit makes them admirable subjects for large-scale cultivation. Still another point in favor of both milkweed and dogbane is the fact that a most valuable fiber may be obtained from their stems. Russia has developed large plantations of dogbane primarily for the fiber which is used in the manufacture of paper. Still another by-product of these rubber-fiber plants has been suggested. The soft hairs on their seeds may be used as a substitute for kapok and similar products. Finally, both milkweeds and dogbanes are regarded as of great importance in the making of honey because of the abundant nectar secreted by the flowers.

Of the four likely sources of natural rubber in the United States, guayule is the only one which has been grown and processed commercially. The yield and quality of rubber obtained are high, but the small size of the plant and the restricted areas in which it can be grown may make it difficult to produce anything like the quantity needed.

Chrysil rubber obtained from rabbit-brush is still in the experimental stage. Its quality and yield are not as good as that of guayule but the plant is larger, it can be grown in greater areas of the western United States, and it might well supplement guayule since the method of processing is virtually the same.

In spite of the fact that milkweed and dogbane as sources of rubber are in the early stages of experimentation, they are probably the most promising native sources for the United States. The ease with which they are propa-

gated vegetatively, the fact that they grow naturally the country over, and that the quality and quantity of the rubber may be greatly increased and improved by selection and cultivation make them worth considering. Nor should the possible valuable by-products of these two plants be forgotten.

R. E. W. Jr.

FIBERS

The fiber has taken its place beside the rubber molecule in making World War II headlines. Both rubber and fibrous materials are essential to United States industry, and heretofore both have been largely imported.

Among commercially important fibers we find animal fibers (such as wool and silk), mineral fibers (such as asbestos and spun glass), and vegetable fibers (such as cotton and linen). Animal and mineral fibers are well known and of relatively few types, and need not be mentioned further. Vegetable fibers are more diverse, more abundant, more used, and hence more important. In time of war attention is especially focused upon the production and importation of these valuable raw materials. If the source of supply for certain fibers is cut off (as it has been with abacá from the Philippines, jute from India, etc.), we must look for substitute plants nearer home, preferably within the country, or at least within this hemisphere. Surprisingly enough, finding substitute fiber plants is not the most difficult part of the problem, for in almost any park, farm woodlot, or Missouri hillside can be found innumerable fiber-bearing plants. A paucity of certain commercial fibers exists in the United States today not because fiber plants are uncommon, but rather, as will be discussed later, because there are few tested fiber plants readily adaptable to our existing industrial set-up.

Man early turned to plant fibers as a source of lighter, cooler, and more flexible clothing than that furnished by animal hides. Also, he needed a form of cordage for his bows, snares, and nets. Then too, fibrous plant materials were well adapted for the covering, binding, and strengthening of primitive dwellings. As civilization developed, more and more uses were found for plant fibers, until to-day probably well over a thousand fibrous plants are used to a greater or lesser extent. Of these, a great many are cultivated, and some have been cultivated for so long a time that even the story of their origin from the wild state is lost in antiquity. Flax remnants are found in Swiss lake-dwelling remains of Stone Age; ancient Egypt knew fine linen; cotton was used by aboriginal nations of the New World and Asia; ramie has been grown in the Orient since the earliest times.

The importance of plant fibers in modern life cannot be underestimated. Almost every branch of modern industry uses plant fibers directly or in-

directly. Among the more important modern uses we may mention the following:

(1) TEXTILES.—The fibers are twisted together by appropriate machines into thread or cord which in turn may be woven into fabrics. Long, durable, pure fibers that are pliable, lustrous, and exhibit proper cohesiveness are most prized. Linen and cotton cloths, burlap, netting, binder twines, and rope are important commercial textile products.

(2) PAPER.—Fibers from spruce, pine, and various hardwoods are most used, and they need not be perfect nor especially pure. The wood is ground or treated chemically to separate the fibers which are then floated on to a screen, pressed, dried, often bleached and sized. The common penny post-card consists of 100 per cent chemical pulp and some resin; high-grade note-book paper of a mixture of chemical pulps, rag pulp, resin and starch; wrapping paper of unbleached chemical pulp.

(3) STUFFING MATERIAL.—For use in mattresses, life-preservers, caulk-ing, packing, etc. Any clean resilient fibrous material will do as long as it will not mat and will not easily absorb liquids. Kapok is most satisfactory in life preservers. Spanish moss is often used as a substitute for horsehair stuffing.

(4) BROOMS AND BRUSHES.—Tough, stiff fibers or even roots or twigs are satisfactory. The tassel of broom-corn, commonly grown in Missouri, is a standard material in the making of sweeping brooms.

(5) HANDICRAFTS AND ARTS.—For basketry, natural cloths and laces, tourists' curiosities, etc. The material will be distinctive and locally abundant in the region where used, as, for example, the Panama-hat "palm" in Tropi-cal America for hats; the paper mulberry in the Far East for the manufacture of tapa cloth; the lace-bark tree in Jamaica to make lace-like ornaments.

(6) SOURCE OF CELLULOSE.—Pure clean fibers of high cellulose content are treated chemically to produce cellulose acetate, from which can be made rayon, plastics, cellophane, photographic film, etc.

Having indicated the widespread importance of fibers, it may be well to explain just what a fiber is. To the botanist a fiber is a long, tapered, thick-walled cell found in certain tissues of the plant. There are the so-called soft fibers (those near the bark) and wood fibers (found in the wood). The cell is dead, with a small cavity down its center, and perhaps can be vizual-ized as an especially thick-walled soda straw with the ends pinched together. The cell may be only about 1 mm. long (less than 1/16 of an inch) or up to 200 mm. (about 8 inches) in length, and is usually about 0.03 mm. wide. In milkweed, for example, the fibers are about an inch long, 1/800 of an inch wide, with walls about 1/2000 of an inch thick. The thick walls

consist of a basic framework of cellulose, throughout which certain other substances may be interspersed. Elongate clusters of these cells constitute bast or bast fibers.

Long, tough clusters of cells, sometimes called fibers, especially by manufacturers, are usually plant-conducting or "piping" systems and consist of many thick-walled cells rigidly stuck together. These are the so-called hard fibers of Monocotyledonous plants (plants in the palm, banana, pineapple, amaryllis families, etc.). Sometimes, also, whole rootlets, twigs, or special branchlets are classified in industry as fibers. Examples are broom-corn tassels, bamboo stems, broom-root roots.

As previously indicated, soft fibers are generally found in stems just beneath the bark; wood fibers occur throughout the wood of a tree or shrub; hard fibers are scattered in parallel rows throughout the stems or leaves of Monocotyledonous plants.

Some important fiber plants used throughout the world to-day are mentioned below. Few of these grow in Missouri or even in the United States. Supply of some has been completely cut off by the war, and a few may even be supplanted in the post-war world by profitable commercialization of little-used types developed for war needs.

1. Textile fibers, the most important class:

COTTON *(Gossypium spp.)*.—Native to the New World tropics and the Orient. An important crop in southeastern Missouri. Fine hairs on the seeds constitute the cotton of commerce. Used chiefly for thread and fabrics.

FLAX *(Linum usitatissimum)*.—Original habitat in doubt. Important crop of northern Europe and some of our cooler and more rainy states; scarcely grown in Missouri. A soft fiber of excellent quality is separated from the stem by rotting away the less resistant tissues, usually under water, a process called "retting." Used chiefly for fine fabrics.

HEMP *(Cannabis sativa)*.—Native to central and west Asia. It is easily cultivated in both temperate and tropical regions, and some is grown in Missouri. The stem produces long, strong, durable bast fibers which are separated by retting. Used especially for cordage, tarpaulins, pump packing, and in upholstery stuffing.

JUTE *(Corchorus sp.)*.—Native of Asia, now cultivated almost exclusively in India. The stem produces poor-grade bast fibers which are separated by retting. Used extensively to make burlap or gunny, but supply at present cut off by war.

RAMIE OR CHINA GRASS *(Boehmeria nivea)*.—Native to Asia; cultivated in the Far East and experimentally in the western United States. The plant

produces excellent, durable bast fibers which, however, are difficult to separate. Used especially for thread and fabrics and in upholstery.

SUNN, SAN- OR SUNN-HEMP *(Crotalaria juncea)*.—Native to Asia and cultivated in the Orient. It yields a strong bast fiber that is used in cordage and making coarse canvas.

ABACÁ OR MANILA HEMP *(Musa textilis)*.—Native to the East Indies and eastern Asia, cultivated extensively in the Philippines and to some extent in Central America. Produces very strong, water-resistant hard fibers which are scraped free from surrounding tissue. Used for cordage and marine cables. Most of our supply has been cut off by the war now when it is especially needed for marine equipment.

HENEQUEN *(Agave fourcroydes)*, SISAL *(Agave sisalana)*.—Native to Mexico and cultivated there. Produce weak, wiry, hard fibers which are separated by scraping. Used for binder twine and other cordage. Other Agaves known as ISTLE and MAGUEY are also of some importance. MAURITIUS HEMP *(Furcraea gigantea)* and CUBAN HEMP *(Furcraea hexapetala)*, plants closely related to the Agaves, are of local importance in the West Indies.

NEW ZEALAND HEMP *(Phormium tenax)*.—Native of New Zealand, cultivated for cordage in California. Tough hard fibers are produced which are separated mechanically.

BOWSTRING HEMP *(Sansevieria spp.)*.—Native to Asia and Africa, cultivated in many tropical countries and in Florida. Fiber similar to New Zealand hemp in type and use. This is the mother-in-law tongue of United States sunrooms.

COIR *(Cocos nucifera)*.—The coconut is found throughout the tropics. Short, coarse, rough fibers of the husk of the nut constitute coir. They are separated by beating after having been soaked for months in sea-water. Used for cordage, rough fabrics, and as stuffing material.

PINEAPPLE *(Ananas comosus)*.—Native to Central America, cultivated extensively in the Philippines. Leaves produce durable hard fibers of excellent quality, but must be extensively processed by hand.

2. *Brush fibers, a less important group of fibers, few of which need be mentioned:*

PIASSAVA FIBERS (from various palms).—Cultivated in the tropics. Produce stiff, coarse fibers which are separated in some cases by retting, in others, mechanically by hand. Used in brushes and sometimes for cordage or weaving.

BROOM-CORN *(Sorghum vulgare var.)*.—Some kinds probably native to America but many sorts introduced from other parts of the world; cultivated extensively in the Mississippi Valley. The tassels or seed-heads are cut and used for whisk and carpet brooms.

3. *Weaving Fibers:*

These are chiefly of local importance and include fibrous material from the Panama-hat palm *(Carludovica palmata)*, grown chiefly in Colombia and Ecuador; various sedges, grasses, and similar plants used in making mats; certain palms and bamboos used in basketry and wicker-work.

4. *Filling fibers:*

Most important of these is KAPOK *(Ceiba pentandra)*, the silk cotton tree, native to the American tropics, but now extensively grown in the Philippines and Ceylon, from which most of our supply is at present cut off. The fibers occur inside the seed-pod, and since they are impervious to water they are extensively used in life-preservers.

Filling materials of minor importance are: Spanish moss *(Tillandsia usneoides)* of the southern United States; seed hairs of several milkweeds (Asclepias) native to the United States; and kapok-like material from a number of tropical plants.

5. *Natural fabrics:*

The entire fibrous system of certain plants is beaten into cloth-like curiosities, commercially unimportant. This group includes paper mulberry *(Broussonetia papyrifera)*, the source of tapa cloth in the Orient, lace-bark tree *(Lagetta lintearia)*, from which lace-like material is made in Jamaica, and several others.

6. *Wood fibers:*

From native trees such as spruce (Picea), fir (Abies), pine (Pinus), beech (Fagus), oak (Quercus), cypress (Taxodium), poplar (Populus), etc., raw material is furnished for most of the paper and much of the plastic industry.

A question in the minds of many people at present is: What plants can be substituted for those fiber plants cut off by the war? As possible answer we might mention some unused or little-used plants capable of being grown in Missouri, or at least the United States.

DOGBANE (Apocynum) produces excellent bast fiber amounting to about 6 per cent of the stem weight (see May, 1930, Garden BULLETIN). In Russia thousands of acres of a similar plant have been put in cultivation and the fiber produced has been manufactured into the Russian "kendyr" paper.

MILKWEED (Asclepias) is similar to dogbane but probably superior to it, especially in yield. The stems of one species *(Asclepias incarnata)* growing wild in the swamps near East St. Louis, Illinois, yield approximately 11 per cent fiber by weight. This fiber is superior to that of commercially cultivated fiber plants grown in the United States, and, in addition, the seed

hairs, seed, and possibly the rubber content of its "sap" might be valuable as by-products. The fiber is almost pure cellulose and conceivably it could displace flax fiber in industrial use. Only Manila hemp exceeds milkweed fiber in either breaking or tensile strength. Milkweeds have been suggested for economic use many times, and only recently a Chicago investigator found the seed-hairs to be an ideal substitute for kapok. Research at the Missouri Botanical Garden has shown the plant to have excellent commercial possibilities.

CORN OR MAIZE *(Zea Mays)*.—Recent investigations have found a number of new uses for corn stalks, and corn stems may in the future supply, at least partially, the cellulose demands of modern industry. A few years ago paper was manufactured at Danville, Illinois, from the corn stems collected in that region. However, since corn fiber is of poor quality and the handling and cleaning of the stems difficult, the plant will probably not become a serious peace-time competitor with the majority of fiber plants.

HIBISCUS and most other native members of the Mallow family produce bast fibers of fair quality in their stems. Some tropical mallows are of minor commercial importance (species of Abutilon, Hibiscus, Sida, Urena) and could be cultivated in Florida. Okra *(Hibiscus esculentus)* is frequently grown in Missouri.

CAT-TAIL *(Typha latifolia)* gives a high yield of a poor-grade fiber. However, in Germany, at the close of the last war, fibers from this plant were specially processed to produce a good quality wool substitute. In addition, the roots and rhizomes furnished carbohydrate by-products. The species grows well in Missouri in marshy places.

COLORADO RIVER HEMP *(Sesbania exaltata)*, which grows wild in west-central United States, yields a textile fiber much used by the Indians. Other species of Sesbania are commercially grown for their fiber in the Orient.

PINE needles *(Pinus spp.)* can be used to some extent in making paper and cloth. In Missouri native pine is found only in the southern part of the state.

LINDEN *(Tilia americana)*, a tree growing well in Missouri, is reported to have a usable bast fiber just under the bark. The wood is of commercial importance.

PEAT *(Sphagnum sp.)* contains a useful fiber but extraction is expensive and could probably only be practiced efficiently in regions where peat is naturally abundant, as, for example, in Sweden.

Since fiber plants are so abundant, it might be asked: Why aren't we growing commercial substitutes for those necessary fibers no longer obtainable? The answer is:—First, heretofore we've not needed these dif-

ferent fibers—we've been content to use the ones with which we already were familiar and for which we had an industrial set-up. During peace time it has not been practical to junk functioning processes for new ones requiring new specialized machinery to process a type of fiber which might or might not prove a financial success. At present new machinery is scarcely obtainable, and machinery now in use in standardized processes would have to be repeatedly tested and altered to handle new raw materials. For example, a roller crusher for flax stems will not handle the larger, more woody milkweed stems; a cotton gin is not made to properly separate milkweed seed from seed-hair. Second, to work out the kinks in any commercial process takes several years of experimentation. It is more than an overnight job to dovetail and coordinate manufacturing processes, especially around an uncertain market supply of an untried fiber. In fact, many potentially valuable fiber plants have had no market value at all and are unobtainable in quantity. This leads us to a third point. Growers do not produce plants with an uncertain market value. What farmer would raise even an acre of milkweed unless guaranteed beforehand that his crop would be needed? The supply will always lag a year or more behind the demand. The grower must be educated to the production of the new crop. In all probability, he would be reluctant to try the cultivation of a strange crop even if the demand were assured.

Only when the above-mentioned difficulties are overcome do we need worry about the actual growing of fiber plants. They must then be thoroughly tested as to adaptability to cultivation, best methods of harvesting, storing, processing, etc. Seed or plants must be made available to growers after experiments to develop the finest and most productive sorts have been conducted. All this takes time and money. This is why, of the many unused fiber plants known to botanical science, few can supply the immediate demands of the war even at a high price.

ROBERT W. SCHERY.

NOTES

The Henry Shaw Gardenway Association held a meeting at the Arboretum Trail House, Gray Summit, on May 24. About 35 members attended.

Dr. Edgar Anderson, Geneticist to the Garden, spoke to the genetics seminar at the University of Missouri, May 15, on "Races of *Zea Mays*."

Dr. David C. Fairburn, Horticulturist to the Garden, gave a talk to the Zeta Beta Chi Sorority, at the Coronado Hotel, June 2, on "Garden Flowers."

Mr. George H. Pring, Superintendent of the Garden, gave an illustrated lecture on "Basic Training in Air Raid Control", to the 39th Street Business Association, June 3.

The biology classes of the Wood River High School, Wood River, Ill., accompanied by Mr. W. E. Hopper, Biology Instructor, visited the Garden, including the library and herbarium, on May 16.

The article "Courage in War and Courage in Plants," by Mr. Ladislaus Cutak, in charge of Succulents at the Garden, from the April number of *Garden Life* was reprinted in the March number of *Desert Plant Life* (**14**: 59) under the title, "Gardening as a Courage Builder." Mr. Cutak also has an article in the June number of *Garden Life* (**15**:46) entitled "Cacti are Ideal House Plants."

Dr. Edgar Anderson, Geneticist to the Garden, and Mr. George H. Pring, Superintendent of the Garden, served on the judging committee at the annual flower show of the Associated Garden Clubs of Kirkwood, held at the newly remodeled Kirkwood Railway Station, May 23. Mr. Pring also acted as one of the judges, June 10, in the lawn contest which is held annually under the auspices of the Northwoods Country Club, of Normandy, Missouri.

Recent visitors to the Garden Library include: Dr. E. R. Spencer, Professor of Botany, McKendree College, Lebanon, Ill.; Dr. Lewis J. Stadler, Principal Geneticist, U. S. Dept. Agr., Bur. Plant Ind., University of Missouri, Columba; Mr. Howard E. Gilkey, landscape architect, Oakland, Calif.; Dr. Alfred C. Kinsey, Professor of Zoology, University of Indiana, Bloomington; Dr. George A. L. Sarton, Professor of History of Science, Harvard University, Cambridge, Mass.; Dr. Maxine Larisey, Assistant Professor of Biology, Judson College, Marion, Ala.

STATISTICAL INFORMATION FOR MAY, 1942

GARDEN ATTENDANCE:

Total number of visitors	31,691

PLANT ACCESSIONS:

Total number of plants and seed packets received as gifts	860

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought	11
Total number of books and pamphlets donated	162

HERBARIUM ACCESSIONS:

By Purchase—

Dutilly, Artheme—Plants of Arctic North America	221

By Gift—

Anderson, Edgar—Plants of Illinois	12
Bettis, Mrs. James R.—*Rumex Acetosella* L. from Missouri	1
Brenner, Louis G., Jr.—Plants of Mississippi	4
Brinker, Rev. Robert—Photographs of type specimens of *Schoenocaulon*	10
Brinker, Rev. Robert—Plants of Florida and Alabama	210
Bureau of Plant Industry, Washington, D. C.—*Matelea lanata* (Zucc.) Woodson from Texas	1
Hubricht, Leslie—Plants of Missouri, Kansas, Oklahoma, and Arkansas	69
James, Leslie—Plants of Alabama	5
Lenz, L. W.—Photographs of *Helenium heterophyllum* DC.	2
Meyer, Frederick G.—Non-vascular plants, chiefly from western United States	102
Parks, H. B., by R. B. Clark—Plants of Texas	7
Reynolds, Howard C.—Plants of Nebraska	8
Tolstead, W. L.—Plants of Iowa, Nebraska, and Minnesota	500

By Exchange—

Reynolds, Howard C.—Plants of Richardson County, Nebraska	123
Rhoades, William—Plants chiefly from Tennessee	20

By Field Work—

Woodson, R. E., Jr. and R. W. Schery—Plants of Panama	22
Total	1,317

STAFF
OF THE MISSOURI BOTANICAL GARDEN

THE GARDEN, 2315 TOWER GROVE AVENUE, ST. LOUIS, MISSOURI

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American Midland Naturalist

"Should be of great use to local garden clubs, and for the scientific worker who is concerned with the local flora it should be invaluable."

National Horticultural Magazine

"Carefully and critically done, so that it should find wide and enthusiastic reception at the hands of all who enjoy being acquainted with the rich native flora of Missouri."

Rhodora

"The most comprehensive spring flora ever issued for any state. . . . Notable for presenting its data in simple non-technical English, yet with thorough scientific accuracy. Book's value not limited to Missouri."

Field Museum Notes

For sale by the Missouri Botanical Garden. Price $3.00

MISSOURI BOTANICAL GARDEN BULLETIN

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SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date until his death in 1889 it was maintained under his personal direction. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was chosen by Mr. Shaw and he definitely indicated that he wished it called by that name. The Garden passed at his death into the hands of a Board of Trustees, designated in Mr. Shaw's will, and the Board so constituted, exclusive of certain ex-officio members, is self perpetuating. By a further provision of the will the immediate direction of the Garden is vested in a Director, appointed by the Board. The Garden receives no support from city or state but is maintained almost exclusively from the estate left by Henry Shaw. Since 1939 many Garden Clubs and interested individuals have contributed to a "Friends of the Garden Fund" which is used in developing the new Arboretum, located at Gray Summit, Mo. The Arboretum (1) serves as a source of plants, trees and shrubs for the city Garden; (2) affords areas for gradually establishing a pinetum, a wild-flower reservation and various other features on a scale not possible in the city; (3) provides greenhouses for some 20,000 orchid plants.

The city Garden comprises 75 acres, where about 12,000 species of plants are grown, both out of doors and under glass. It is open every day in the year except New Year's Day and Christmas; week days, 8:00 a. m. until sunset; Sundays, 10:00 a. m. until sunset. The greenhouses are closed every day at 5:00 p. m.

The main entrance to the Garden is at Tower Grove Avenue and Flora Place, on the Sarah car line (No. 42). The Tower Grove bus (No. 21), direct from downtown, passes within three blocks of the main entrance.

PICEA OMORIKA
(Thirteen years old, twenty inches high)

Missouri Botanical Garden Bulletin

Vol. XXX SEPTEMBER, 1942 No. 7

A REPORT ON THE SERBIAN SPRUCE

The Serbian Spruce *(Picea Omorika)* is one of the most picturesque of evergreens. A full-grown specimen is tall with pendent branches and upsweeping tips, producing a very narrow silhouette. Seemingly, this is the tree which furnished the inspiration for the classical evergreen of our Christmas cards. Recently it has attracted considerable attention, perhaps because of its reputed hardiness and drought resistance, but more likely because no large specimen could be found here. Thus the gardeners' propensity for "something different" was given full play.

One of the many functions of an Arboretum is to grow or to attempt to grow all trees which may succeed in a particular region, and then to report on their behavior. The following note on the Serbian Spruce may prove enlightening and interesting, although it holds but little promise of success.

Seeds of *Picea Omorika* were obtained from F. M. Ellis, of Griffin, Ga., in 1927, and again in 1928, but neither lot germinated. A third attempt was made the following year, when a quarter pound of seed was imported direct from A. Grumwald, Wiener-Neustadt, Austria. This shipment produced many hundreds of seedlings, which were grown in one long coldframe, receiving the usual cultivation, irrigation, and protection from the sun by lath shades.

When the famous plant explorer, the late Mr. E. H. Wilson, visited the Arboretum in June, 1930, he questioned the identity of the seedlings, but was satisfied when informed of the seed source. However, he insisted that this region was "too hot" for this particular spruce, and subsequent experience has proved him correct.

The nursery inventory of 1932 listed 300 seedlings of *Picea Omorika,* but during the very dry summer of 1934 over one-half of these died. In 1939 those remaining were moved to the new nursery where they have lived without a single growing season to their liking. The inventory of May, 1942, lists just 32 specimens, none of which exceed 2 feet in height although they are now thirteen years old.

During October, 1940, the writer was able to obtain five fine specimens from Mr. C. R. Page, of the Ohio State Experiment Station Arboretum, at Wooster, Ohio. They were about 3 feet tall, well grown, and beyond the uncertainties of seedling trees. After being carefully dug and wrapped in burlap, they were hauled by automobile to Gray Summit and planted there less than 48 hours later. In spite of every attention, one tree died in August, 1941; another in May, 1942; and it is safe to predict that those remaining will not last many years.

Reporting the failure of a tree to grow well is an unpleasant task, and while the gardener never quite loses all hope it appears that the Serbian Spruce must be classified as unsuited for this region.

G. H. P.
A. P. B.

THE MECHANIZED EQUIPMENT OF A BOTANICAL GARDEN

That almost everyone enjoys a flower show can be attested to by the great crowds visiting local horticultural displays. However, the show is the accomplished fact, and few people are aware of the labor and equipment which have been used in its preparation. Even though the display be nothing more than a new Petunia, to be outstanding Petunias have as one important requirement: the p oper soil at the proper time. Some might say that this means nothing more than the judicious use of a spade by an experienced gardener; but really this is not the case. The ancient art of the gardener has undergone many changes, and the greatest has been due to the introduction of machinery. It is safe to say that to-day no very ambitious gardening project is undertaken which does not require some machinery. The Missouri Botanical Garden has probably gone farther in the use of standard kinds of machinery, and certainly much farther in the development of specialized kinds, than any comparable institution.

The right soil at the right time at least requires means of transportation, and three 1½-ton dump trucks are in service. One of these at the Arboretum is changed into a flat-bed stake-body at certain seasons. But it may not be sufficient to simply haul and dump a load of soil; perhaps more humus is needed. In this day the addition of humus to a soil is something of a problem. Usually, as the advantages of machinery became apparent, teams were disposed of and stables were converted into garages. Thus in recent years stable manure has been denied the gardener. The answer to this lack are the green manures, organic mulches, composts, and to some extent, sludge from sewage-disposal plants.

The growing of a green manure is a simple farming operation. An

SOIL SHREDDER

FEEDING SOIL SHREDDER

International Farmall "20" tractor is used at the Arboretum, and an International Industrial "4" is used in town. Both are equipped with pneumatic tires, and both have the usual complement of gang plows, discs, and harrows. To grow a green manure, the usual procedure is to plow, disc, and harrow the land and then sow the seed with a grain drill. In spring, soybeans are sown, and in fall, winter rye is used. In either event such crops are not harvested but after making full growth are plowed under. Since it is seldom possible to mature both rye and beans on the same land during a twelve-month period, it has been the practice to plow under the rye in April and thereby give the soybeans the longer growing season. These are usually permitted to grow until frost, by which time they are mature and very "woody." When plowed under some stalk fragments can be found for twelve months after. Green manuring improves the physical condition of the soil and increases its fertility but seldom adds sufficient humus to satisfy all requirements.

The short cut to adding humus is by spreading compost on the surface of the soil or plowing it under, depending upon what use will be made of the ground. Composts must be considered as the machine-age stable manures. If every bit of plant refuse is saved, usually so much slowly decomposing "woody" material will be included that fragments can be found for several seasons after it is returned to the land. So long as such material can be seen in the soil we can be certain that at least a portion of the needed humus is available. Some machinery is required to produce compost in amounts sufficient for large-scale gardening. Trucks are used to gather and pile all plant refuse, and after decomposition to haul the compost to the area where it is to be used. So far the production of compost seems to have been little changed by the introduction of machinery. However, a uniform compost cannot be obtained unless either a soil shredder or a hammer mill is used. A soil shredder not only eliminates laborious turning of compost but it also does away with endless sifting and screening. The roughest kind of plant refuse is usable within twelve months after collection if it is passed through a soil shredder after six or nine months or just as soon as it has become thoroughly wet, and then allowed to decompose a short while longer. If leaves are gathered while damp they may be shredded after six months and used immediately. The shredder in use at the Garden was constructed some ten years ago from parts of discarded lawn mowers, paint sprayers, etc. It consists principally of a 4-wheeled steel chassis on which a gasoline engine of 1½ H. P. is mounted. At the other end is the engine-driven rotor made of many round bars which shred the compost as it falls upon them. This type of machine readily removes such unwanted material as bricks, rocks, and

cinders simply by throwing them much farther than it does the more resilient compost. The commercial models now available are very satisfactory.

After the nursery has been properly "rested," plowed, disced, and planted, the next operation is cultivating. Since the plants are usually lined out in rows, the cultivator must be a type which will work between them. The conventional "row-crop" tractor with corn-cultivating attachments is satisfactory when the nursery stock is moved each year and neither grows too high nor spreads too much during one summer. If some plants tend to spread and others to grow in height and all remain longer than a single season then a cultivator which will work between the rows must be used. For this purpose the Gravely Model "D" tractor has proven satisfactory. This machine is self-propelled and is steered and handled like a plow. The cultivator teeth are placed ahead of the machine and are adjustable from 1 to 3 feet in width. There is one drive wheel, astride which the air-cooled motor is mounted, the depth wheels in front helping to maintain the balance.

Although seed drills, potato planters, and other specialized planting equipment are in general use, the horticulturist is seldom concerned with machinery to place plants in the ground. However, there is one exception. Large balled trees cannot be planted without a device for lifting and transporting their great weight. A crane of some sort is usually employed, and the adaptation of one in the model made and used at the Garden seems worthy of description. It is a trailer unit designed to be towed and powered by a tractor. The tree is lifted and lowered by a winch operated through the power take-off shaft of the tractor. The winch is a worm-gear type requiring no brakes to hold the load, and several lifting speeds are available through the installation of a motor-car transmission in front. This tree mover will work on hillsides; it will operate on ground much too soft for trucks; and it does not have to be carefully blocked and shored before lifting the tree. Of course, it is much too slow for moving trees any distance over highways, but it is quickly placed in position and is an excellent unit for work on large acreages.

Mention has been made of plows, discs, and harrows in preparing soil for the nursery or greenhouse. A somewhat recent development replaces all these and in one operation produces a better seed-bed than do the conventional tools in many trips over the ground. This tool is called a "tiller", being marketed as the Roto-tiller, Arends Tiller, and Seaman Tiller. The last, designed to be operated from the power take-off shaft of a tractor, is used at the Arboretum. With this equipment it is possible to shred the soil to a depth of 10 or 12 inches and while doing so thoroughly incorporate any kind of humus, no matter how dry, rough or strawy, it may be. In preparing beds for Rhododendrons it has been the practice to add whatever

humus was available. After two tillings it is quite difficult to distinguish such diverse forms as sawdust, orchid peat, stable manure, or leaf mold. The soil is uniform in texture, very fluffy, and does not dry as quickly as when plowed.

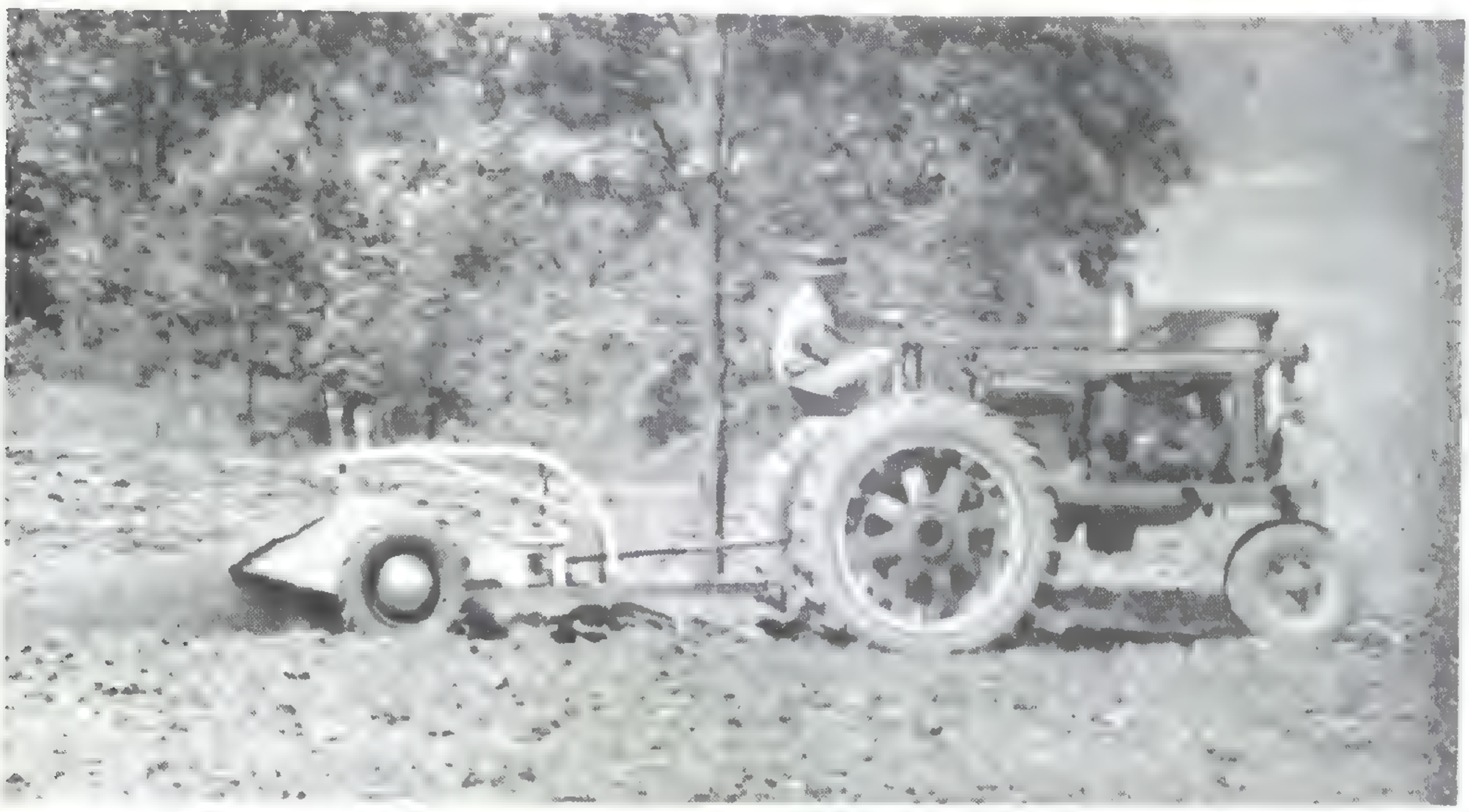
The generally excellent blue grass in the Arboretum is due largely to carefully timed mowing. With the acreage involved only power-driven mowers can be used. All large open areas are cut with a 7-foot sickle-bar mower mounted on the tractor. All plant groups with less than the 12-foot clearance required for the tractor are mowed with a National Sickle-bar Mower. This is a self-propelled machine, cutting a swath 40 inches wide and steered by the operator who walks behind. Every operation of mowing, haying or harvesting of blue grass is done by machinery.

The harvesting of blue grass seed is becoming one of the really important operations of the year. It is the result of a scientific study during which it became apparent that there were many kinds of blue grass in the Arboretum and that the seeds of some of them should be collected and grown on for observation. To harvest the seed a special machine was designed and built by the Garden and has proved entirely satisfactory for small areas. Two years later a large model made to be towed by a truck was purchased from the Peppard Seed Co., Kansas City, Mo. In both of these machines a nail-studded wooden drum revolves at high speed and literally strips the ripe seed from the grass and throws it into a container at the back. The usual farm-harvesting machinery—combine, binder, thresher, etc.—are of little value in harvesting blue grass. After the seed is gathered it must be "cured" or dried and then cleaned in an elaborate stationary plant. The work has been done without charge by the Ed. F. Mangelsdorf Seed Co., of St. Louis, as their contribution toward the development of hardier strains of blue grass. In 1941, when over a ton of seed was gathered, they found it necessary to send it to their plant at Atchinson, Kansas.

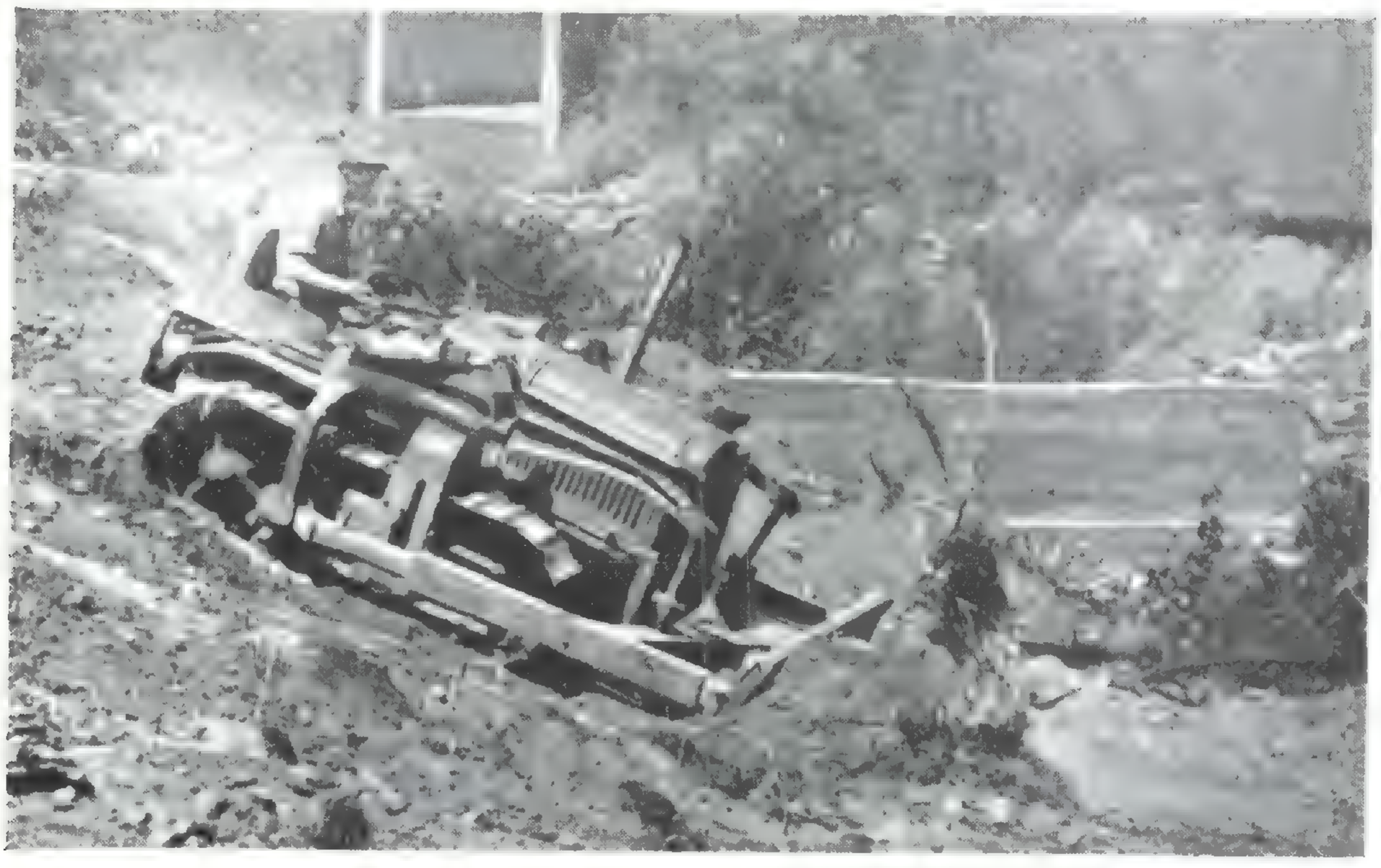
Mowing, of course, does not begin until all seed has been harvested. If, after mowing, the amount of hay produced is considerable it is picked up with a hay-loader towed by a truck and then stacked in piles. This material is used as a mulch around plants or as a cover on newly graded road shoulders to hasten the re-establishment of sod. It will be seen that the only non-machinery operation in the handling of blue grass is the actual sowing of the seed and the stacking of the hay.

Another unit used with the F-20 tractor is a power sprayer for insect control. This is a trailer towed by the tractor and powered through the power take-off shaft. A Hardie Sprayer with a 300-gallon tank and a 30-gallon per minute pump has ample capacity for solid-stream spraying of the tallest trees and with the proper gun can be used in the Pinetum, orchards,

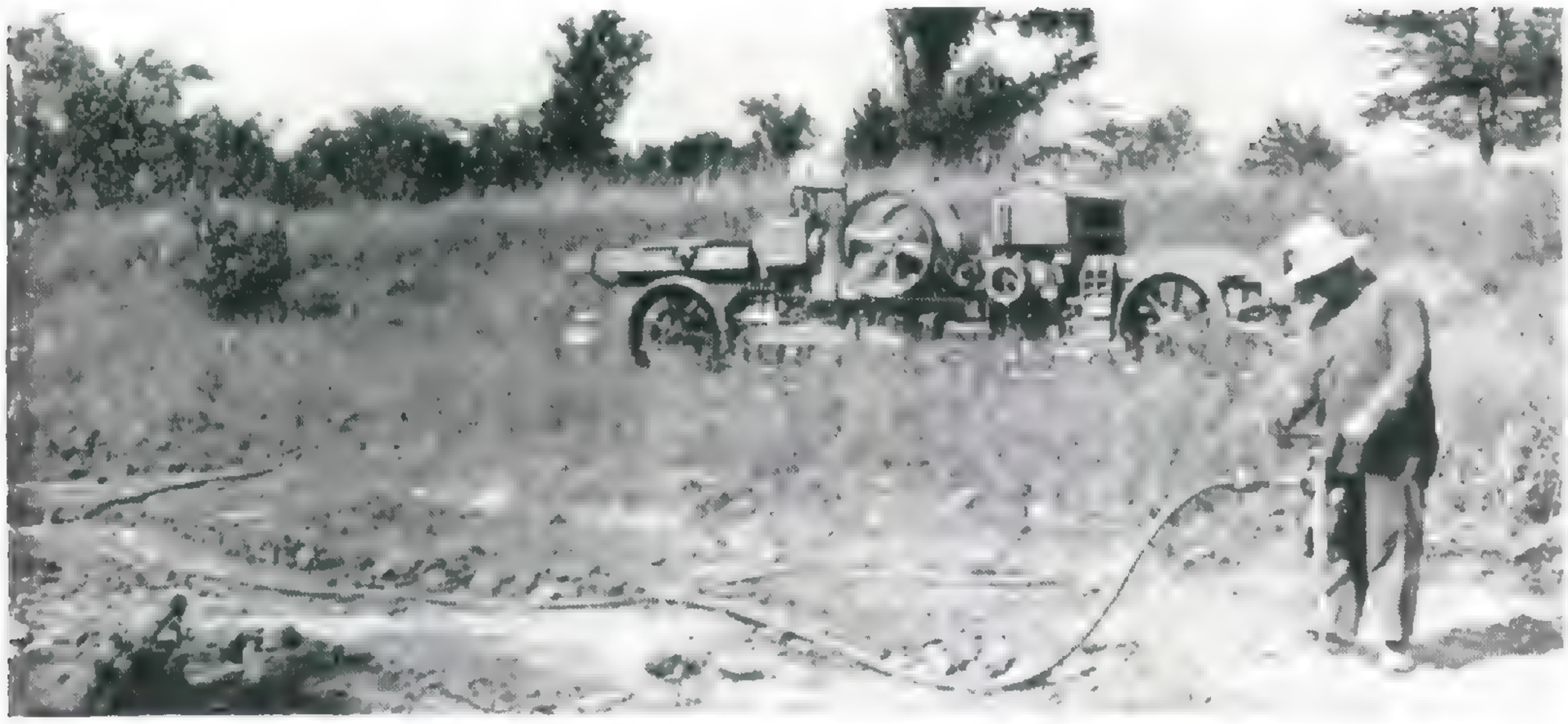
TREE-MOVER WITH 2½-TON CRABAPPLE



SEAMAN TILLER WORKING IN BOXWOOD GARDEN



INTERNATIONAL BULL-GRADER IN ARBORETUM LAKE SPILLWAY



DRILLING HOLES FOR DYNAMITING

SAWMILL AND LUMBER SHED

TANK TRUCK AS EQUIPPED FOR IRRIGATION, FIRE FIGHTING AND SLUDGE DISTRIBUTION

and forests. The large pneumatic tires give the unit ground clearance and permit travel over soft ground in early spring. At 600 pounds pressure the solid-stream nozzle will reach a height of 75 feet or more and might be considered as auxiliary fire-fighting equipment provided it could be got into action quickly enough.

It is seldom possible to plant even a few shrubs without doing some grading. Sometimes only a wheelbarrow and shovel are needed, but at the Arboretum the extensive changes made in the topography have required larger equipment. All heavy grading or large earth-moving jobs since 1939 have been done with an International T-20 (crawler type) tractor equipped with a Bucyrus-Erie "bull-grader." This seems to be the one "must" machine in the development of an Arboretum. In the hands of a competent operator it can make fire trails almost as fast as it moves over the ground. In road building it is possible to grade within .2 feet of the exact elevations and with a proper complement of grading and rooting plows, chains, steel cables, etc., it becomes a versatile unit always in use where hard or heavy work is being done. For the "finish" grade on a road-bed the same tractor is coupled to a 7-foot blade grader.

Road building sooner or later requires the use of dynamite, which in turn calls for air-driven tools—rock drills, breakers, etc.—and an air compressor. The compressor, used at the Arboretum is unique, no part of it being less than sixteen years old. Portability is a requirement in this type of work, and this compressor is mounted on a solid rubber-tire observation balloon trailer of World War I vintage. The Sullivan horizontal compressor is almost as venerable, while the motor used for power was salvaged from a Cletrac tractor purchased about 1926. When ready for use this rig weighs about four tons, and while this weight would be excessive in a compressor which is often moved, ours is seldom moved more than a mile or two and the weight makes for stability. It has given trouble-free operation, represents an investment of less than $75.00, and was used for all rock work on the bridges, reservoir, and where needed for road building.

Like most Arboretum equipment the air compressor is very versatile. When the drive belts are reversed and an ordinary saw mandrel and 36-inch saw are mounted at the back it becomes a cord-wood saw. With the building of a sliding table all small trees and tree tops can be readily reduced to cordwood. There are two more uses for the Cletrac engine mentioned above: driving the belt conveyor when the year's coal supply is piled 14 feet high in the coal shed, and operating the sawmill.

Recently a Fisher & Davis #0 Sawmill has been set up and the Cletrac engine drives the 56-inch saw. This mill converts logs into timber rather than allowing them to decay in the woods or reducing them to cordwood.

There is always considerable need for lumber of many sizes which can be used in construction or maintenance work. Although the Cletrac engine is not large enough for this operation, it will suffice until a power plant of ample size can be procured.

Extensive plantations of trees and shrubs cannot be maintained without supplementary irrigation. Some mobile water carrier must be provided since the cost of piping water to all sections of the Arboretum is prohibitive. For this purpose an International D-S 40 truck tractor is used; this is coupled to a Fruehauf 1,025-gallon tank trailer, and the entire unit rolls on 8.25 x 20 tires. With the ten speeds of the truck it has been possible to haul water

INTERNATIONAL D-S "40" HAULING 65-FOOT POLES TO ARBORETUM TRAIL HOUSE

anywhere, even over steep hills. Trees and shrubs are watered when newly planted and whenever necessary for the following two years; during 1941, 600,000 gallons of water were hauled and used for this purpose.

Water for irrigation is taken from fire plugs which are connected by 6-inch mains to reservoirs. The largest reservoir, near the Trail House, holds 300,000 gallons, being filled by pumping from a shallow well near the Meramec River. Two pumps are used, a 3 x 4 Westco turbine and a 4-inch Sterling centrifugal. Each water-supply installation is a problem in itself, and these pumps are mentioned because they have been very satisfactory. Another reservoir underground, for use in the greenhouses, cold-frames, and seed-beds, catches the rain from the greenhouse roofs and holds 150,000 gallons. The tank truck can be filled at any of the seven fire hydrants supplied by these two reservoirs. The one at the greenhouses is filled from the Pinetum lake whenever the use exceeds the rainfall, which seems to be a chronic condition. The same tank truck may be driven to a fire line and

while there serve as a mobile reservoir from which pack-sack pumps can be filled.

In addition, sludge from sewage-disposal plants must be hauled and distributed. The sludge is pumped directly through a diaphragm pump into the tank and then distributed through hoses by gravity to the area to be fertilized. This is an excellent fertilizer which is not at all appreciated in modern gardening or agriculture. Provided that only residential sewage is passed through the plant or no appreciable amount of manufacture waste or garage grease-rack offal enters the sanitary sewer system, the resultant product, after a proper period of digesting, is perhaps equal to good stable manure. Needless to say, all such material is used in Europe and the Orient, and in a much more unpleasant form. It will require American ingenuity to develop

ROAD MACHINERY

sewage-disposal systems in all communities and especially to find cheap ways of making the sludge available to gardeners. The equipment at the Arboretum is probably the most elaborate in use anywhere in a large-scale experiment of this sort.

All the roads in the Arboretum are gravel-surfaced, the gravel coming from a bar on the Meramec River. Lately this has been loaded by drag-line and hauled and spread by dump truck. Maintenance is not difficult after the road has become "stabilized" through grading and rolling. Weeds are controlled and the driving surface kept smooth by periodic use of a blade grader, steel drag, and roller, all being towed by tractor. The macadam roads in the city garden are a different problem since they have a limestone base and a waterproof wearing surface, usually asphalt. Maintenance in this case consists of renewing the surface by applying a new coat of asphalt into which more fine gravel is rolled and imbedded. Machinery has been developed to use the "emulsified asphalts" which have lately come into prominence

and are especially suitable for repairing and for constructing minor roads. The emulsified kinds are quickly applied and require no heating but must be under pressure in order to get even distribution. The simplest and most satisfactory way so far developed is by the use of compressed air since they behave much like water. For this purpose a 200-gallon tank of asphalt was mounted on a trailer, and above this an air tank, with a gasoline engine and compressor at the front of the rig. When compressed air is "bled" into the lower tank containing the asphalt, the material is forced through a hose and out the standard gun and nozzle.

This does not exhaust the list of machinery in use in a botanical garden or arboretum since no mention has been made of lawn mowers, lawn sweepers, or the thousand other items in daily use. The list does, however, include most of those units which have become somewhat indispensable or which were especially developed to do some difficult or time-consuming operation. It does include some, such as the tree mover, asphalt distributor, and grass stripper, which are an entirely new approach to a difficult job. It also includes a note on such strictly experimental work as that concerned with the use and distribution of sewage-disposal sludge. It is safe to predict that this problem will attract far more attention, both at the Arboretum and perhaps on a national scale, in the near future.

A. P. B.

THE GREATER ST. LOUIS VICTORY GARDEN HARVEST SHOW

At the request of the National authorities, the Missouri Botanical Garden will devote all its facilities toward making a success of the Greater St. Louis Victory Garden Harvest Show, one of the 7,000 such shows being held throughout the country this fall. For the first time in its history, the Garden will charge an admission fee during the three days of the Show, October 3, 4 and 5, the proceeds to be donated to the relief agencies of our armed forces. Special features contributed by the Garden will be displays of fiber and rubber plants, house plants, and rare old books from the Library. In addition, the former country residence of Henry Shaw will be furnished with original pieces of his furniture, and members of the Junior League, in costumes of the Shaw period, will act as guides in the building. As a part of the setting in the "Old Residence", a number of flower arrangements by the most successful followers of the art in this section will be used. The Museum Building will house an exhibit of the Herb Society, and, if plans can be carried through, the famous May color photographs of flower arrangements will be on loan and shown there for the three days of the show.

The admission fee of thirty cents (including tax) will entitle the visitor to all the features of the Show.

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Schedule, Dr. C. R. Conroy
Speakers, Edward C. Palmer

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Greater St. Louis Dahlia Society
Greater St. Louis Association of Gardeners
St. Louis County Farm Bureau
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National Nurserymen's Association
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Garden Club of Greater St. Louis
Urban League
St. Louis County Junior Chamber of Commerce

NOTES

The August number of *The Flower Grower* (**28**:375) has reprinted the article "Lightning and Trees" from the December 1941 Garden BULLETIN.

Mr. Ladislaus Cutak, in charge of Succulents at the Garden, gave an illustrated lecture, "Introducing the Cactus Family," before the Henry Shaw Cactus Society of St. Louis, August 9.

As has been the custom for a number of years, on August 25 a wreath of orchids was placed on the tomb of Henry Shaw in the Garden mausoleum to commemorate the day of his death.

Mr. Paul A. Kohl, Floriculturist to the Garden, showed the motion-pictures, "Four Seasons in the Missouri Botanical Garden," before the Ladies' Social Room of the Rose Hill Masonic Lodge, June 9.

"Fiber Plants to Meet the War Emergency," an article by Dr. Robert W. Schery, in the June number of the Garden BULLETIN, was reprinted in the June 30 and July 15 numbers of *Chemurgic Digest* (**1**:94-95, 99-101).

The September number of the ANNALS OF THE MISSOURI BOTANICAL GARDEN (Vol. 29, No. 3) was issued during the month, with contents as follows: "Commentary on the North American Genera of Commelinaceae," by Robert E. Woodson, Jr.; "A Revision of the Genus Bumelia," Robert B. Clark; "Monograph of Malvaviscus," Robert W. Schery.

Mr. Ladislaus Cutak, in charge of Succulents at the Garden, has published the following articles recently: "The Henry Shaw Cactus Club," in the August number of the *Journal of the Cactus and Succulent Society of America* (**14**:118-119); "Introducing the Cactus Family," in the July *Garden Life* (**15**:54-55); and "Desirable Cacti for the Beginner," in the August *Garden Life* (**15**:59-60).

Mr. George H. Pring, Superintendent of the Garden, has given talks on "The Greater St. Louis Victory Garden Harvest Show" before the following groups: meeting of the Air-Raid Wardens of Zone 2, July 8; Ladue Florists' Club, August 3; Greater St. Louis Association of Gardeners, August 4; and the St. Louis Horticultural Society, August 7.

Dr. Carroll W. Dodge, Mycologist to the Garden, returned in August from Guatemala where he has been exchange professor at the University of Guatemala since January, 1941. In July, 1942, he received an honorary degree from the Guatemalan government and gave the principal address at the convocation, his subject being "Agricultural Problems in Relation to the Four Freedoms."

Visitors to the Garden library during the summer months include the following: Lieut. Stanley Bettoney, formerly graduate student at the Garden; Mr. Delzie Demaree, of Arkansas Agricultural and Mechanical College, Monticello; Mr. Otto Degener, author of books and papers on the Hawaiian flora, of Honolulu, H. I.; Dr. Harry Fuller, professor of botany, University of Illinois, Urbana; Mr. Richard Inglis, student in botany, Grinnell College, Grinnell, Iowa; Mr. Leonard Jansen, student in botany, Texas Technological College, Lubbock, Texas; Dr. Boris Krukoff, tropical plant explorer; Dr. Mary Maxine Larisey, assistant professor of biology, Judson College, Marion, Ala.; Mr. Reid Moran, graduate student in botany, Cornell University, Ithaca, N. Y.; Mr. Charles Denny Rogers III, author of botanists' biographies, of Columbus, Ohio; Mr. Russell J. Seibert, Agent Rubber Investigations, U. S. Bureau of Plant Industry, recently stationed at Jeremy, Haiti; Dr. Henry Schmitz, Dean of the School of Forestry, University of Minnesota, St. Paul; Mrs. Richard Walker (Helen Bramsch), formerly

graduate student at the Garden and the University of California, Berkeley; Dr. and Mrs. Roland Walker, Dr. Walker, head of the biology department Rensselaer Polytechnic Institute, Troy, N. Y., Mrs. Walker, of the botany department, Smith College, Northampton, Mass.

STATISTICAL INFORMATION FOR JUNE-AUGUST, 1942

GARDEN ATTENDANCE:

Total number of visitors in June	22,113
Total number of visitors in July	23,008
Total number of visitors in August	28,116

PLANT ACCESSIONS:

Total number of plants, bulbs and packets of seeds donated in June	299
Total number of plants and packets of seeds donated in July	17
Total number of plants and packets of seeds donated in August	290

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought in June	19
Total number of books and pamphlets donated in June	238
Total number of pamphlets bought in July	15
Total number of books and pamphlets donated in July	195
Total number of books bought in August	2
Total number of books and pamphlets donated in August	95

JUNE

HERBARIUM ACCESSIONS:

By Purchase—

University of California, Berkeley, by T. H. Goodspeed—Plants of South America	531
Woodson, R. E., Jr.—Plants of Panama	1,167

By Gift—

Anderson, E.—*Veronica hederaefolia* L. from St. Louis County, Missouri	1
Atkins Institute of the Arnold Arboretum, Cuba—*Agave* sp.	1
Beldt, Mrs. A. C.—*Liparis liliifolia* (L.) Richard from Missouri	1
Berry, E. C.—Plants of Missouri and Puerto Rico	56
Cutler, Hugh C.—*Asclepias latifolia* (Torr.) Raf. from Texas	1
Hester, J. Pinckney—*Agave* from Nevada	7
Hubricht, Leslie—Plants of Missouri, Arkansas, and Oklahoma	67
Martinez, Maximino—*Picea* sp. from Mexico	1
Runyon, Robert—Plants of Texas	8
Schery, Robert W.—Plants of Missouri	2
Whetzel, H. H.—*Martinia panamensis* Whetzel from Panama	1

By Exchange—

Barkley, Fred—Plants of Montana	199
Demaree, Delzie—Plants of Arkansas, mainly	1,500
Museum of Northern Arizona—Plants of Arizona	71
Pomona College—Plants of California, Nevada	114
Stratton, Robert—Plants of Oklahoma	76
U. S. National Museum—Plants of the United States and South America	338
University of California, by Lee Bonar—California fungi	182
University of California—Plants of California, chiefly	207
Total	4,531

JULY

By Purchase—	
Lundell, C. L.—Plants of British Honduras and southern Mexico	166
By Gift—	
Berry, E. C.—*Selenicereus MacDonaldiae* Britton & Rose from Horticulture	1
Campbell, Joy—*Liquidambar Styraciflua* L.	1
Chandler, Albert—Plants of central United States	43
Demaree, Delzie—Plants of Arkansas	6
Guild, Mrs. George—Plant of Horticulture	1
Hubricht, Leslie—Plants of Arkansas	6
Rose, Lewis Samuel—Plants of California	1,253
Stanford University—Plants of Mexico	7
Stratton, Robert—Plant of Oklahoma	1
By Exchange—	
Cornell University—Plants of New Mexico and Arizona	21
Daily, W. A.—Myxophyceae	45
Field Museum of Natural History—Plants of Panama	2
Iowa State College—Plants of Iowa and Arizona	203
Rhoades, William—Plants of eastern United States	228
By Transfer—	
Fairburn, D. C.—*Malpighia coccigera* L. of Horticulture	
Pring, George H.—*Nepenthes* of Horticulture	7
By Field Work—	
Woodson, R. E.—Plants of Panama, collected by H. von Wedel, P. Allen, R. E. Woodson & R. W. Schery	1,397
Total	3,389

AUGUST

By Gift—	
Barkley, F. A.—*Ochoterenaea colombiana* Barkley	1
Darker, G. D.—Fungi of Ontario, Missouri and Georgia	30
Demaree, Delzie—Plants of Arkansas	3
Hammond, Ida May—*Ustilago* sp.	1
Hester, J. Pinckney—Plants of Arizona	6
Hubricht, Leslie—Plants of Illinois and Missouri	12
Ledman, O. S.—*Sedum* sp. from Horticulture	1
Morley, Thomas—Plants of California	22
Seibert, R. J.—*Garcinia* sp. from the Canal Zone	3
Williams, L. O.—Descriptions and illustrations of orchids	4
By Exchange—	
Arnold Arboretum of Harvard University—Miscellaneous duplicate herbarium specimens	1,969
Chrysler, M. A.—Ferns of Central America	125
Instituto Miguel Lillo de la Universidad Nacional de Tucuman—Plants of Argentina	357
Rocky Mountain Herbarium—Plants of western North America	125
By Transfer—	
Pring, George H.—*Nepenthes* spp. of Horticulture	2
By Field Work—	
Woodson, R. E.—Plants of Panama	200
Total	2,861

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Field Museum Notes

For sale by the Missouri Botanical Garden. Price $3.00

MISSOURI BOTANICAL GARDEN BULLETIN

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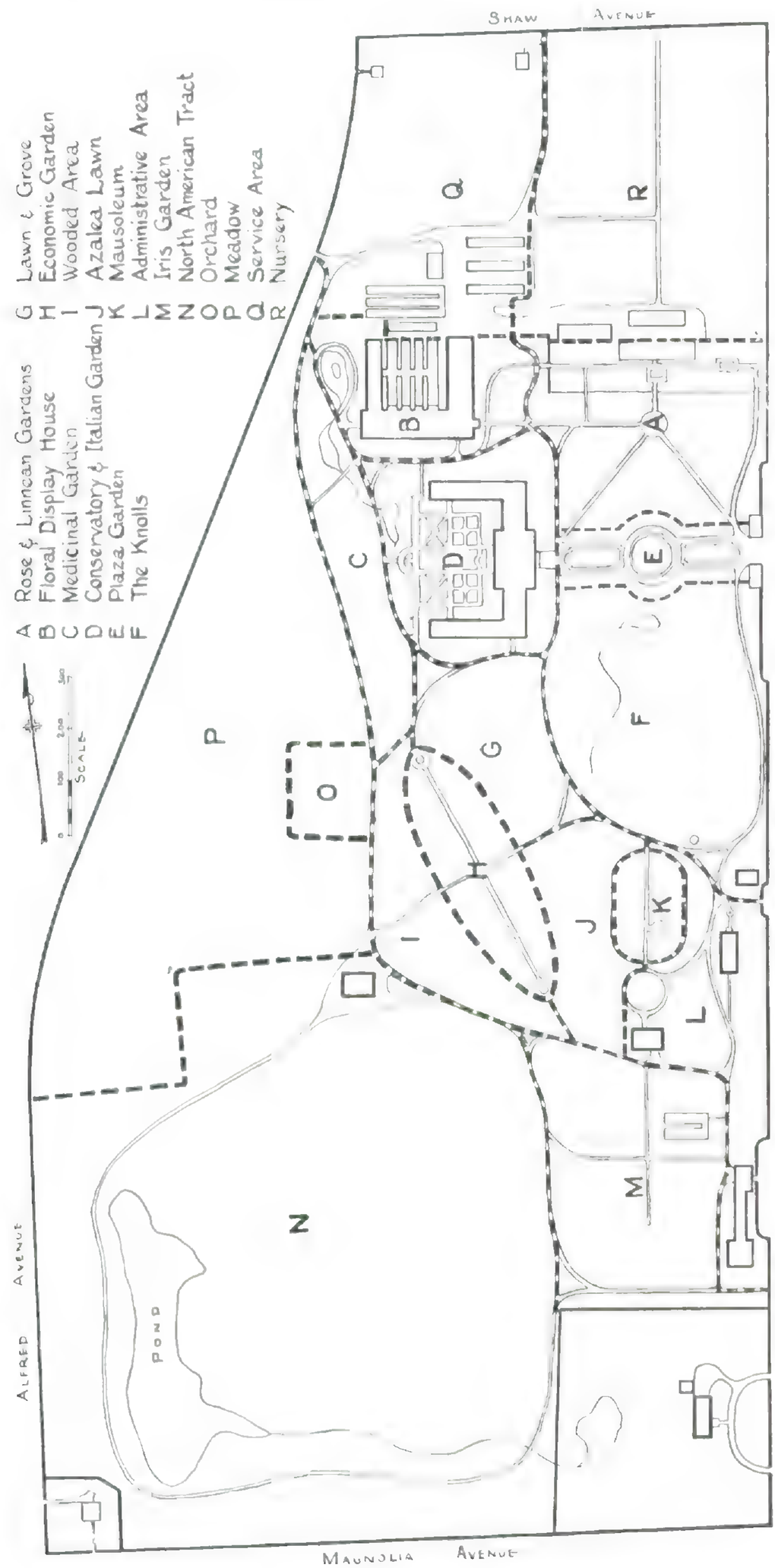
SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date until his death in 1889 it was maintained under his personal direction. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was chosen by Mr. Shaw and he definitely indicated that he wished it called by that name. The Garden passed at his death into the hands of a Board of Trustees, designated in Mr. Shaw's will, and the Board so constituted, exclusive of certain ex-officio members, is self perpetuating. By a further provision of the will the immediate direction of the Garden is vested in a Director, appointed by the Board. The Garden receives no support from city or state but is maintained almost exclusively from the estate left by Henry Shaw. Since 1939 many Garden Clubs and interested individuals have contributed to a "Friends of the Garden Fund" which is used in developing the new Arboretum, located at Gray Summit, Mo. The Arboretum (1) serves as a source of plants, trees and shrubs for the city Garden; (2) affords areas for gradually establishing a pinetum, a wild-flower reservation and various other features on a scale not possible in the city; (3) provides greenhouses for some 20,000 orchid plants.

The city Garden comprises 75 acres, where about 12,000 species of plants are grown, both out of doors and under glass. It is open every day in the year except New Year's Day and Christmas; week days, 8:00 a. m. until sunset; Sundays, 10:00 a. m. until sunset. The greenhouses are closed every day at 5:00 p. m.

The main entrance to the Garden is at Tower Grove Avenue and Flora Place, on the Sarah car line (No. 42). The Tower Grove bus (No. 21), direct from downtown, passes within three blocks of the main entrance.



MAP OF THE MISSOURI BOTANICAL GARDEN

Missouri Botanical Garden Bulletin

Vol. XXX OCTOBER, 1942 No. 8

A GUIDE TO THE HARDY TREES AND LARGE SHRUBS OF THE MISSOURI BOTANICAL GARDEN

The following list is intended to serve as a guide to the hardy trees and large shrubs now growing in the St. Louis Garden and also it may be useful to gardeners in selecting woody plants for cultivation in this vicinity. Although great effort has been taken to make this guide complete, it was not possible to include every species.

The list is divided into three groups: (1) large trees, usually more than 25 feet in height in this locality, valued chiefly for shade and timber; (2) small trees, seldom more than 25 feet tall, cultivated for their conspicuous flowers and fruits; and (3) large shrubs which in their native habitats may be trees but fail to reach arborescent proportions here.

The plants are listed alphabetically according to the common name, but for definiteness the botanical name is also included. The name of the person who first gave the plant its name follows, and, since many plants were originally described by Linnaeus, his name has been abbreviated "L." The locality where the plant grows wild is given next. Other pertinent notes are sometimes included, such as: the derivation of the name; outstanding horticultural characteristics; properties and uses of the wood.

Reference is made to the other numbers of the Missouri Botanical Garden BULLETIN where further information may be found. Much of the data contained herein has been taken from Rehder's *Manual of Cultivated Trees and Shrubs*, revised edition, 1940; Hough's *Handbook of the Trees of the Northern States and Canada*, 1907; and Harlow and Harrar's *Textbook of Dendrology*, 1937.

The accompanying map gives the location of the plant in the Garden. For example, the list states that the Pyramidal English Oak may be found at "K." Turning to the map we find that "K" stands for the Mausoleum; and on the east side of the walk we shall find two specimens each bearing a label.

LARGE TREES

Acacia: False, see Black Locust; Three-thorned, see Honey Locust.

Alder, Black or European (*Alnus glutinosa* Gaertner). Eurasia, N. Africa; occasionally escaped in N. E. N. Am. Originally introduced for the manufacture of charcoal. Grows vigorously in very wet localities, but is rather short-lived. **C.**

Ash, Blue (*Fraxinus quadrangulata* Michaux). E. Cent. U. S. A valuable timber tree. The bark contains a mucilaginous substance that turns blue upon exposure to the air. **G.**

Ash, European (*Fraxinus excelsior* L.). Europe, Asia Minor. In cultivation for centuries. One of Europe's best-known timber trees. Frequently planted as a street tree in America. **G, M.**

Ash, Green (*Fraxinus pennsylvanica* Marshall var. *lanceolata* Sargent). E. N. Am. Very hardy tree of rapid growth and desirable habit. Although naturally a bottom-land tree, it may be grown in dry, sterile places. Not distinguished commercially from the following species. **G, M.**

Ash, White (*Fraxinus americana* L.). E. N. Am. One of the most valuable hardwoods of the American forests. Grows on rich slopes and in river bottoms. The wood is heavy, hard and strong, and finds use in the manufacture of tool-handles, furniture, etc. **General.**

Basswood, see American Linden.

Beech, Blue or Water, see American Hornbeam.

Beech, European (*Fagus sylvatica* L.). Europe. Long in cultivation. One of the most important timber trees of Europe where it is grown in pure or mixed stands under forest management. **B.** The Purple or Copper Beech (var. *atropucinea* Weston) differs from the species in its purplish foliage. Cultivated since 1860. **D, M.** The Rose-pink Beech (var. *roseo-marginata* Henry) resembles the preceding variety except that the leaves have a pink border. **J.**

Birch, Canoe or Paper (*Betula papyrifera* Marshall). N. N. Am. Fast-growing, short-lived tree scattered among the conifer-hardwood forests, and thriving in cool, moist places. The bark is impervious to water and formerly was used for canoes. **N.**

Birch, Cherry, Sweet or Black (*Betula lenta* L.). E. U. S. Because the bark resembles that of the Black Cherry, *Prunus serotina* Ehrhart, the tree is sometimes called Cherry Birch, and the dark color gives it the name Black Birch. Owing to the sweet aromatic flavor of its leaves and bark it is also sometimes called Sweet Birch. Oil of wintergreen was formerly prepared commercially from the twigs and bark. The wood is heavy, hard and strong and when freshly cut is of a rosy hue which deepens upon exposure to the light. It takes a brilliant polish and so is valued for furniture;

when carefully preserved, it acquires with age the appearance of mahogany. **N.**

BIRCH, RIVER, RED, or WATER (*Betula nigra* L.). E. U. S. Graceful tree with slender, drooping branchlets. Scattered along banks of streams. The only birch that sheds its seeds in late spring. Heat-tolerant and smoke-resistant. [BULLETIN, May 1926.] **B, F, G, J, N.**

BIRCH, YELLOW (*Betula lutea* Michaux). Cent. E. N. Am. The most important of American birches, furnishing most of all timber marketed as birch. Grows best in moist, cool localities. Its shaggy bark is its distinguishing feature: on old trunks it becomes papery and curled in ribbon-like strips. Its wood is hard and strong and is used in furniture manufacturing; also makes one of the best fuel woods. **N.**

BITTER-NUT (*Carya cordiformis* K. Koch). Que. and E. U. S. Although usually found on wet bottom-lands, this tree is hardy on poorer soils and is probably the most abundant and uniformly distributed species of hickory. The wood is heavy, hard and strong, and is used for tool-handles, firewood, etc. **F, N.**

BOX-ELDER (*Acer Negundo* L.). Ont. and E. U. S. Scattered on deep, moist soils, also on poorer sites, this species is perhaps the most aggressive of maples. Not a decorative tree, but rapid in growth and short-lived. In the Prairie States it is planted as windbreaks and as street trees. The wood is light in weight, soft, easily worked and is used for paper pulp. [BULLETIN, March 1937]. **B, D, L, N, Q.**

BUCKEYE, SWEET or YELLOW (*Aesculus octandra* Marshall). S. E. U. S. Regarded as "sweet" in comparison with the following species. The flour from the nuts produces a paste of greater adhesive qualities than ordinary pastes. **J, K, M.**

BUCKEYE, OHIO or FETID (*Aesculus glabra* Willdenow). E. Cent. U. S. The foliage and twigs give off a disagreeable odor when bruised. The wood is light in weight, soft, rather tough, easily worked and is used for artificial limbs, splints and paper pulp. The nuts, or "buckeyes," are often carried by superstitious people to keep away rheumatism. **G, M, N, R.**

Buckeye, see also Horse-chestnut.

Buttonball-tree or Buttonwood, see American Sycamore.

Catalpa, Blue, see Royal Paulownia.

CATALPA, COMMON (*Catalpa bignonioides* Walter). Ga. to Fla. and Miss.; naturalized as far north as N. Y. Planted ornamentally for its showy panicles of white and purple-tinted flowers. **General.**

CATALPA, WESTERN or HARDY (*Catalpa speciosa* Warder). S. Ind. and Ill. to W. Tenn. and N. Ark.; naturalized elsewhere. Exceedingly sensitive to soil conditions: on rich soils young trees will make an annual growth

of 2½ feet. Widely planted throughout the Midwest and when grown in the proper soil will produce more good fence-posts in a short time than any other native tree. The wood is very durable and is also used for railroad ties. **J.**

Cherry, Black, Wild Black, or Rum (*Prunus serotina* Ehrhart). Ont. and E. U. S. Highly ornamental in early May when in flower. In June its shiny black fruits are eagerly sought by the birds. The wood is hard, strong, very close-grained, and is one of the most valuable woods for furniture making and interior decorating. **D, F, J, L, M, N, R.**

China-tree: see Golden Varnish-tree; Wild, see Western Soapberry.

Cigar-tree, see Catalpa.

Coffee-tree, Kentucky (*Gymnocladus dioicus* K. Koch). E. Cent. U. S. The large compound leaves turn yellow in autumn and fall before the petiole, while the conspicuous pods persist during the winter. In the early days the seeds were used to some extent as a substitute for coffee. **A, D, I, M, N.**

Cork-tree, Amur (*Phellodendron amurense* Ruprecht). E. Asia. Introduced about 1856. The fruit and foliage, when crushed, give off a strong odor of turpentine. **A, D, F, G.**

Cottonwood (*Populus deltoides* Marshall). Que. and E. U. S. Much planted because of its rapid growth and luxuriant foliage. Attains immense proportions. Especially common on moist alluvial soils throughout the Plains and Prairie States where a winding belt of its glossy dark green crowns indicates the presence of a water course. Proves to be relatively drought-resistant. In early May pistillate trees shed great quantities of cotton. **General.**

Cucumber-tree (*Magnolia acuminata* L.). E. U. S. Hardiest of the magnolias. Planted as an ornamental shade tree because of its pyramidal habit and attractive foliage. The wood, similar to that of the tulip-tree, is light weight and light-colored, soft, easily worked and durable. [Bulletin, March 1922]. **A, G, L.**

Cypress, Bald (*Taxodium distichum* Richard). S. E. U. S. This hand-some tree is found in swampy localities where it develops strongly buttressed trunks and its roots send up steeple-shaped projections, commonly called "knees." In cultivation the Bald Cypress is characterized by its spire-like crowns, its feathery light green foliage and its slow-growth. Owing to its extreme durability and freedom from excessive shrinking or warping, cypress is one of the choicest woods for lumber, for woodwork exposed to weather, such as shingles or "shakes," for cooperage, posts, railroad ties, etc. [Bulletin, Feb. 1926; Dec. 1932; June 1940; Nov. 1941]. **A, B, C, F, G, M, N, Q.**

BALD CYPRESS
(Taxodium distichum)

Elm, Chinese (*Ulmus parvifolia* Jacquin). E. Asia. Introduced in 1794. Its small, glossy, dark green leaves remain on the tree until late in the fall. [Bulletin, Nov. 1923]. **G, J.**

Elm, English (*Ulmus procera* Salisbury). Europe; early introduced into America. Tall tree with straight, nearly excurrent stem and spreading or ascending branches, forming an oval or oblong head. The leaves remain green several weeks later than those of American species. Its roots unfortunately develop suckers. **D, I, J, M, N, Q, R.** The Variegated English Elm (f. *argenteo-marginata* Rehder) has leaves that are striped or spotted white. **F, I.**

Elm, Siberian or Dwarf Asiatic (*Ulmus pumila* L.). E. Asia. Introduced to N. Amer. in 1906. Erroneously called "Chinese" Elm. Of rapid growth, but short-lived and with brittle branches. Recommended as a street tree for arid regions. May be used as a screen plant when sheared twice a year. [Bulletin, Feb. 1938]. **General.**

Elm, Slippery or Red (*Ulmus fulva* Michaux). Que. and E. U. S. Prefers rich, well-drained limestone soils. Well-known to pioneer woodsmen on account of its mucilaginous inner bark which was chewed to quench the thirst. **M.**

Elm, Smooth-leaved (*Ulmus carpinifolia* Gleditsch). Eurasia, N. Africa. Long in cultivation. A variable species with many garden forms. **F.**

Elm, Water (*Planera aquatica* Gmelin). S. E. U. S. Restricted to swamp-lands of the Costal Plain. Closely related to the elms. Rare in cultivation. **N.**

Elm, White, American, or Water (*Ulmus americana* L.). E. N. Am. Generally found in open lowland fields where standing water may accumulate in spring and fall, rarely occurs in dry, sandy soils. The trunk usually divides into several erect, strongly arched limbs that terminate in numerous slender, often drooping branchlets, the whole forming a vase-shaped crown of great beauty and symmetry. Highly favored as an avenue tree, but will not tolerate root crowding. **General.** In front of the Old Residence there are three seedling trees of the famous Daniel Boone Judgment Tree. [Bulletin, Feb. 1922; Sept. 1941]. **J, L.** The "Moline Elm" is a selected strain of narrow columnar habit. **G.**

Elm, Wych or Scotch (*Ulmus glabra* Hudson). Eurasia. Long in cultivation as an ornamental shade tree, forming a massive crown. The foliage persists several weeks later than that of the White Elm. The bark remains fairly smooth even on large trunks, hence the Latin name *glabra*, which means smooth. The Old English word "wych," meaning drooping, refers to the character of the lower branches. [Bulletin, April 1923]. **F, J.**

WYCH OR SCOTCH ELM

(Ulmus glabra)

EUONYMUS, WINTERBERRY (*Euonymus Bungeana* Maximowicz). E. Asia. Introduced in 1883. Tree with arching branches, dense light green foliage and a profusion of pinkish fruits. It suckers freely and in mid-May when in flower has a very disagreeable odor. **General.**

Ginkgo, see Maidenhair Tree.

Goldenrain-tree, see Golden Varnish-tree.

GUM, COTTON or TUPELO (*Nyssa aquatica* L.). S. E. U. S. Confined to deep swamps and margins of streams and ponds. It develops a broad-base, and its foliage becomes large and lustrous. The timber is commercially important and the light, spongy root-wood is used locally for bottle corks and fish net floats. **N.**

GUM, SOUR or BLACK (*Nyssa sylvatica* Marshall). Ont. and E. U. S. Found in swamps and at margins of streams and lakes. In summer its glossy, bright green foliage is an attractive feature and its autumn coloration of red and purple is remarkably vivid. **N.**

GUM, SWEET or RED (*Liquidambar Styraciflua* L.). E. U. S. and Mex. Occurs for the most part on rich moist alluvial soils. A desirable ornamental because of its symmetrical habit and its brilliant autumn coloration. Sweet Gum is one of the most important commercial hardwoods of the United States, exceeded only by the oaks in the annual amount of timber cut. Used as a veneer, it takes finishes in imitation of more expensive woods. **General.**

HACKBERRY, COMMON (*Celtis occidentalis* L.). Que. and E. U. S. Scattered among the hardwoods, Hackberry makes its best growth on rich alluvial soils, but is commonly found on limestone outcrops and seems to succeed even under adverse conditions of soil and moisture. When cultivated, this tree produces curious dwarfed branch clusters familiarly known as "witches' broom." **General.**

HACKBERRY, MISSISSIPPI (*Celtis laevigata* Willdenow). S. E. U. S. Similar to the preceding species, but the bark is characterized by conspicuous warty excrescences, and the leaf edges are smooth instead of saw-toothed. **M.**

HORNBEAM, AMERICAN (*Carpinus caroliniana* Walter). E. N. Am. Usually considered as a "weed" tree because of its small size and poor form, this species is very shade-tolerant and occurs as the "understory" in mixed hardwood forests. **N.**

HORNBEAM, EUROPEAN (*Carpinus Betulus* L.). Europe to Persia. Long in cultivation, chiefly as a dense, slow-growing hedge or screen. **H, J.**

HORNBEAM, HOP (*Ostrya virginiana* K. Koch). E. N. Am. Sometimes called "Ironwood" because of its toughness. The wood finds use in the manufacture of tool handles, implements, etc. **M, N.**

HORSE-CHESTNUT, COMMON (*Aesculus Hippocastanum* L.). Europe: Balkan Peninsula. Introduced in cultivation in 1576. Of narrow pyramidal habit and arching branches. One of the most showy of flowering trees, its large erect panicles appear in late April or early May. Often planted for its dense shade and its coarse-textured dark-green foliage. **D, F, G, I, J, K, L, M.**

HONEY LOCUST
(Gleditsia triacanthos)

Indian-bean, see Catalpa.

Ironwood, see American Hornbeam or Hop Hornbeam.

Lime-tree, see Linden.

LINDEN, AMERICAN (*Tilia americana* L.). E. N. Am. Prefers rich, moist, but well-drained soils. The sweet-scented, pendent flowers appear amid the foliage in early June. Besides timber, the linden is a source of

MAIDENHAIR TREE
(Ginkgo biloba)

honey which has a slightly more acid tang than clover honey. The Iroquois made rope from the inner bark by soaking it in water for several days to allow the non-fibrous portions to rot, after which it was twisted into the desired form. **G, I, L, M, N.**

LINDEN, BEE-TREE (*Tilia heterophylla* Ventenat). S. E. U. S. Similar to the American Linden but with larger leaves pale on the under-surface. **L.**

LINDEN, BROAD-LEAVED (*Tilia platyphyllos* Scopoli). Europe. Cultivated for centuries. Smaller than the American Linden. **F.**

LINDEN, SILVER (*Tilia tomentosa* Moench). Eurasia. Round-headed tree with small dark green leaves silvery on the under-surface. **I.**

LOCUST, BLACK or YELLOW (*Robinia Pseudoacacia* L.). S. E. and Cent. U. S.; naturalized elsewhere in N. Am. and also in Europe where it was introduced about 1601. On moist rich soils or in limestone regions its average growth is 2-4 feet a year. Once established it often increases by means of root-suckers and is therefore planted for erosion control and in shelter-belts. Grown ornamentally for its pendent and fragrant white flowers but chiefly planted for its heavy and durable wood which is used in wooden-ship construction (as insulator pins or "tree-nails"), for fence posts, railroad ties, firewood, etc. [BULLETIN, June 1926]. **G, I, K, L, N, P.**

LOCUST, HONEY or SWEET (*Gleditsia triacanthos* L.). S. E. U. S. Generally occurs in open places because of its intolerance to shade. It develops a broad rounded, or lofty flat-topped crown with drooping lateral branchlets. Compound thorns along the trunk and branches give the tree a characteristic aspect in winter. When trimmed, it makes an impenetrable tall hedge. According to some writers, the tree owes its name to the fact that the pods contain a sweetish substance between the seeds; while other authorities assert that bees gather large quantities of honey from its inconspicuous flowers. **General.** The thornless variety (var. *inermis* Willdenow) has slender, unarmed branches. The wood is heavy, strong and very durable. Used for railroad ties, for fence posts and the manufacture of agricultural implements. [BULLETIN, Sept. 1932]. **G, M, N, P, Q.**

LOCUST, WATER or SWAMP (*Gleditsia aquatica* Marshall). S. E. U. S. Resembles the thornless honey-locust except that the pods bear solitary seeds. **M.**

MAIDENHAIR TREE (*Ginkgo biloba* L.). Introduced to N. Am. about 1784. The native habitat of this plant is generally believed to have been northwestern China. Had it not been for the Buddhist and Taouist monks of China and Japan who cultivated this tree about their temples, it would in all probability have become extinct. Interesting because of its bizarre branching and its foliage which resembles that of the maidenhair fern. [BULLETIN, Oct. 1914; May 1924; June 1936]. **A, D, F, G, I, J, M, R.**

MAIDENHAIR TREE IN FRUIT

Magnolia, Mountain or Cucumber, see Cucumber-tree.

Maple, Ash-leaved, see Box-Elder.

MAPLE, BLACK (*Acer nigrum* Michaux). Que. and N. E. U. S. Scarcely distinguished from the sugar maple. **N, R.**

MAPLE, NORWAY (*Acer platanoides* L.). Europe, Caucasus. Long in cultivation. Planted ornamentally for its dark green foliage and dense shade. **A, F, I, L, R.** Numerous horticultural forms of which the Schwedler Maple (var. *Schwedleri* Nicholson) is one. It is distinguished by the color of the leaves which are bright reddish when young and dark green when mature. **M.**

MAPLE, RED, SCARLET or SWAMP (*Acer rubrum* L.). E. N. Am. Conspicuous in late winter with its red flowers. Characteristic of swamps but also found in drier localities of the Northeast, often among the white pines and hardwoods. After the first frost, its foliage takes on the most brilliant hues of scarlet and yellow perhaps of any deciduous tree. **I, M, N, P, R.** Two varieties are distinguished in part by their foliage (var. *trilobum* K. Koch and var. *Drummondi* Sargent). **N.**

MAPLE, SILVER (*Acer saccharinum* L.). Que. and E. U. S. Thrives in low bottom-lands subject to occasional inundation. In the Midwest it lines the banks of streams. [BULLETIN, May 1935]. **General.** The cut-leaf form (var. *laciniata* Pax) presents a more graceful appearance. **J.**

MAPLE, SUGAR or ROCK (*Acer saccharum* Marshall). E. U. S. Stately tree with a broadly oblong crown of many branches and dense foliage. Best growth is made in rich, moist, well-drained soils. Its clear sweet sap is the chief source of maple syrup and maple sugar. The wood is prized in furniture manufacturing. **C, G, I, N, Q.**

MULBERRY, PAPER (*Broussonetia papyrifera* Ventenat). E. Asia; occasionally naturalized in E. U. S. Called Paper Mulberry because in the Orient paper of very fine quality is made from its inner bark. Cultivated since 1750. With large soft dull green leaves. It is this species that is planted in front of the St. Louis Public Library. **F, L.**

MULBERRY, RED (*Morus rubra* L.). E. U. S. The fruit, which looks very much like a blackberry, is eagerly sought by birds and is sometimes fed to poultry and hogs. **D.**

MULBERRY, WHITE (*Morus alba* L.). China; naturalized in other parts of the Northern Hemisphere. The foliage of this tree furnishes the best food for the silkworm, and consequently was widely grown in all countries where climatic conditions are favorable. **General.**

OAKS, RED or BLACK *(Quercus)*: Leaves with sharp-pointed lobes; acorns borne on second-year wood, germinating the following spring. [BULLETIN, Feb. 1924].

Black or Yellow Oak (*Q. velutina* Lamarck). E. U. S. Makes best growth on moist, rich, well-drained soils, but often found on dry hillsides. **D, K, N.**

Pin Oak (*Q. palustris* Muenchhausen). N. E. and Cent. U. S. With its broadly pyramidal crown, drooping lower branches, and deeply cut leaves, the tree presents a very pleasing appearance, especially in the fall when the autumnal coloration is at its height. Usually found on bottom-lands. Gaining favor as a street tree because of its resistance to smoke and its ability to flourish even in dry clayey soils when once established. More readily transplanted than many others of this group. [BULLETIN, March 1932]. **General.**

Red Oak (*Q. borealis* F. A. Michaux var. *maxima* Ashe). Cent. E. N. Am. Probably the most important and widespread of northern oaks, producing in the open a short massive trunk with an extensive crown. Widely used as an ornamental because of its comparative ease in transplanting, the autumnal coloration of its leaves, and its symmetrical form. The wood, which is inferior to the White Oak, is used for interior finishing and in furniture. **B, F, G, K, N, Q.**

Scarlet Oak (*Q. coccinea* Muenchhausen). N. E. and Cent. U. S. Generally found on dry sandy soil. Often used as an ornamental on account of its hardiness and brilliant autumnal coloration. **K.**

Shingle or Northern Laurel Oak (*Q. imbricaria* Michaux). Cent. E. U. S. Used by the early pioneers for split shingles or "shakes," hence the name. Best development is made in moist soils along streams or on hillsides. May be grown as a hedge or screen when sheared. **A, D, F, G, H, K, M, N.**

Shumard Oak (*Q. Shumardii* Buckley). Cent. and S. E. U. S. One of the largest of southern red oaks with a long clear symmetrical trunk and open wide-spreading crown. Usually scattered on bottom-lands. The wood is mechanically superior to that of many other red oaks, but unfortunately is not distinguished commercially. **B, D, F, J, L, N.**

Southern Red or Spanish Oak (*Q. falcata* Michaux). Cent. and S. E. U. S. One of the commonest upland southern oaks, particularly characteristic of the drier, poorer soils of the Piedmont region. Develops a short trunk and an extensive rounded crown. **N.**

Willow Oak (*Q. Phellos* L.). S. E. U. S. Open-grown trees are very distinctive with their dense, oblong to oval crowns and bright-green willow-like leaves. Has numerous spur-like branches similar to the Pin Oak, which it is often called in some sections of the South. A bottom-land tree found on poorly drained flats. As an ornamental, Willow Oak

has few, if any, superiors throughout the southern part of its range, and in many southern cities this tree is as common along streets as the White Elm is in the North. **K, N.**

OAKS, WHITE *(Quercus)*: Leaves with rounded lobes; acorns borne on wood of the current year, germinating in the fall. [BULLETIN, Feb. 1924].

Basket, Chestnut or Rock Oak (*Q. Primus* L.). S. E. U. S. Usually found on moist or wet loamy soils which are inundated for short periods in the fall and winter. In quality the wood is exceeded only by that of the best white oak. The common name undoubtedly originated through its use in the production of basket splints. **K.**

Burr or Mossy-cup Oak (*Q. macrocarpa* Michaux). Cent. E. N. Am. A timber tree found on bottom-lands. The peculiarly shaped leaves, fringed acorns, and corky twigs make this plant unique ornamentally. Resistance to smoke and gas further recommend it for landscape planting. It is this species that grows at either side of the stage of the Municipal Opera in Forest Park. **D, K, N.**

Chinquapin or Yellow Chestnut Oak (*Q. Muhlenbergii* Engelmann). N. E., Cent., and S. W. U. S. Often found on dry rocky soil. The leaves strongly resemble those of the chestnut, *Castanea.* **N.**

English Oak (*Q. robur* L.). Eurasia, N. Africa. Stately tree with wide-spreading crown. The leaves remain green until late in the fall. **G, I, K.** The Pyramidal English Oak (var. *fastigiata* A. DC.) has ascending branches and a narrow crown. **K.**

Overcup or Swamp Post Oak (*Q. lyrata* Walter). S. E. U. S. Grows on poorly drained clay soils. Acorn is deeply cupped; leaves are similar to those of the burr oak. **N.**

Post Oak (*Q. stellata* Wangenheim). E. U. S. Found on dry soils and rocky ridges. A small tree with characteristically gnarled branches. Easily recognized by the cross-shaped leaves. **N.**

Swamp White Oak (*Q. bicolor* Willdenow). E. U. S. Occurs along streams, on moist flats or in swamps. Easily recognized by the light-gray scaly bark. **I, J, K, M, N.**

White Oak (*Q. alba* L.). E. U. S. Commercially the most important of the white oak group, furnishing the greater part of the total timber crop. Of slow growth, in the open it has a short stout trunk and wide-spreading branches. The foliage is dull gray-green. **K, N.**

OSAGE ORANGE (*Maclura pomifera* Schneider). S. W. Ark. to E. Tex. This tree is especially suited for use as a hedge plant because of its sharp thorns, its glossy green foliage, and its ability to withstand shearing. The

bark and wood are distinctly orange, but it is the orange-shaped fruit that gives the tree its common name. The wood is heavy, very strong and durable, and is used for railroad-ties, fence-posts, wheel-hubs, etc. The Osage Indians used it for bows, hence the name "Bow-wood" or, as the early French settlers called it, "Bois d'Arc." [BULLETIN, April 1938]. **General.**

PAGODA-TREE, JAPANESE (*Sophora japonica* L.). E. Asia; occasionally naturalized in E. U. S. Cultivated since 1750. Tree with wide-spreading branches terminating in large clusters of creamy flowers in midsummer. The foliage stays green until late in the autumn. [BULLETIN, May 1934]. **A, G, L, M, P, R.**

PAULOWNIA, ROYAL (*Paulownia tomentosa* Steudel). China, cultivated in Japan; escaped in E. U. S. Introduced in 1834. Also called Empress-tree, Princess-tree or Imperial-tree of China. Very attractive in early May with its large, violet, slightly fragrant flowers appearing just before the leaves. The foliage is coarse-textured and casts a dense shade. Somewhat tender in St. Louis and not likely to produce flowers annually. [BULLETIN, Dec. 1922]. **N.**

PERSIMMON, COMMON (*Diospyros virginiana* L.). E. U. S. Especially handsome in autumn with its yellow and orange foliage and ripening fruits. Until thoroughly soft, the fruit is very astringent and is quite variable in quality. Trees bearing more palatable fruit have been developed. **General.**

PISTACHIO, CHINESE (*Pistacia chinensis* Bunge). China. Introduced about 1890. Sometimes planted as a shade tree; also used as understock for the pistachio-nut. **G.**

Plane-tree, American, see American Sycamore.

PLANE-TREE, LONDON (*Platanus acerifolia* Willdenow). Of hybrid origin, about 1700. A large tree with wide-spreading crown. As a shade tree it is much to be preferred to the American Sycamore because of its compact habit and its darker green foliage which persists later in the fall. **A, F, P, Q.**

POPLAR, CHINESE (*Populus Simonii* Carrière var. *fastigiata* Schneider). E. Asia. Introduced in 1862. Handsome poplar of narrow upright habit, with slender branches and rather small, bright green leaves. Longer-lived than the following species. **B, D, F, G.**

POPLAR, LOMBARDY (*Populus nigra* L. var. *italica* Muenchhausen). Europe. Introduced to N. Am. in 1784. Striking because of its formal, columnar habit. **A, B, D, F, J, R.**

Poplar, Yellow, see Tulip-tree.

Pride-of-India, see Golden Varnish-tree.

JAPANESE PAGODA-TREE
(Sophora japonica)

Sassafras (*Sassafras albidum* Nees & Ebermaier). Cent. E. U. S. Handsome at all seasons but especially in the autumn with its vivid scarlet and orange foliage. The leaves are extremely variable, three different forms sometimes occurring on the same tree. Sassafras tea is made by boiling the young, tender roots in water. Generally considered as a "weed" tree, it rapidly invades abandoned farm lands. [Bulletin, March 1937]. **G, J, K, L, M, N.**

Scholar-tree, Chinese, see Japanese Pagoda-tree.

Soapberry, Western (*Sapindus Drummondii* Hooker & Arnott). S. Cent. U. S. and No. Mex. Dark green foliage with sickle-shaped leaflets; large clusters of golden translucent fruit are attractive from late fall until they turn black in January. Sometimes called the wild China-tree because of its resemblance to the China-tree, *Melia Azedarach* L. The name Soapberry is applied because of the detersive properties found in the fruit pulp, making it a possible substitute for soap. **D, J, N.**

Sycamore, American (*Platanus occidentalis* L.). E. U. S. The most massive and perhaps the tallest of deciduous North American trees. Scattered in bottom-lands or lining the banks of streams. Very conspicuous on account of its bark which is light-colored mottled by darker blotches when older. Often planted as a street tree, it has a rather open crown. [Bulletin, May 1922]. **General.**

Sycamore, Maple-leaved, see London Plane-tree.

Tree-of-Heaven (*Ailanthus altissima* Swingle). China; introduced and naturalized in E. U. S. 1784. The only redeeming feature of this aggressive exotic is its ability to flourish on poor hard-packed soils and in the smoky atmosphere of industrial cities. The fruits are rather attractive when ripening but their great number bodes no good for the gardener. The flowers of the staminate tree and the crushed foliage have an exceedingly disagreeable odor, and it is to be wondered why such a blessed name was given such an unholy tree. Of very vigorous habit, certain sprouts have been known to grow an inch a day, 12½ feet a year. [Bulletin, Oct. 1935]. **General.**

Tulip-tree (*Liriodendron Tulipifera* L.). E. U. S. Tallest and perhaps the most massive of North American deciduous trees. No tree of eastern North America produces a trunk of such grandeur. The peculiarly notched leaves borne on long slender petioles tend to tremble in the slightest breeze, hence possibly the application of the name "Poplar." The flowers, which appear in mid- to late May, are rather inconspicuous because of their greenish color. The wood is one of the most valuable of native timbers for interior finishing, cabinet-making, etc. **General.**

Varnish-tree, Golden (*Koelreuteria paniculata* Laxmann). E. Asia. Introduced in 1763. A medium-sized, round-topped tree of informal or

FRUITING BRANCH OF THE TREE-OF-HEAVEN

TREE-OF-HEAVEN
(Ailanthus altissima)

picturesque habit. Chiefly valued for its shade and the large panicles of yellow flowers borne in mid-June. [BULLETIN, Nov. 1926]. **B, G, J, K, L, P, Q, R.**

Virgilia, see Yellow-wood.

WALNUT, BLACK (*Juglans nigra* L.). E. U. S. In cultivation since 1686. One of the choicest of North American hardwoods. The heart-wood is of a rich dark brown color, very durable in contact with the soil and highly prized for furniture, gun-stocks, interior finishing, etc. [BULLETIN, April 1927]. **G, I, M, P.** The nuts are used for food, the following varieties having been developed with thinner shells: KINDER, MCCOY, MILLER, OHIO, STABLER, TEN EYCK, THOMAS. [BULLETIN, Oct. 1919; June 1934]. **O.**

REHDER WING-NUT

(Pterocarya Rehderiana)

WALNUT, TEXAS (*Juglans rupestris* Engelmann). S. W. U. S. Not so valuable as the preceding species. **G.**

White-wood, see Tulip-tree or American Linden.

Willow, Weeping (*Salix babylonica* L.). Originally believed to be the tree of the "hanging gardens" of Babylon, this species comes from China. Its graceful drooping branchlets and its delicate pale green foliage produce an effect unsurpassed by any other tree in the landscape. **F.**

Wing-nut, Rehder (*Pterocarya Rehderiana* Schneider). Of hybrid origin, 1880. With rather slender branches, this tree somewhat resembles a walnut, an ash, or a tree-of-heaven. The wood is useful in cabinet-making. [Bulletin, Oct. 1933]. **R.**

Yellow-wood (*Cladrastis lutea* K. Koch). S. Appalachian Mts. One of the rarest trees of the American forests, this graceful species has smooth gray bark like the beech, and drooping panicles of white flowers. Its desirable habit of growth, its ample clean foliage little affected by blight or insects, and its long stems of pure white flowers make it a very desirable tree for ornamental planting. [Bulletin, Feb. 1923; March 1927]. **F, N.**

Zelkova, Sawleaf (*Zelkova serrata* Makino). Japan. Introduced in 1862. The short trunk divides into many upright and erect-spreading stems, forming a broad round-topped tree. Closely related to the elms, but rarely cultivated. **G.**

SMALL TREES

Almond, Flowering (*Prunus triloba* Lindley). China. Cultivated since 1855. Covered as with snow when in bloom in early April. Edible plum-like fruits ripen in July. Round-headed tree, producing dense shade. **A, B, D, L, M.**

Angelica-tree, see Devil's Walking-stick.

Apple, Common (hybrids with or selected strains of *Malus pumila* Miller). Eurasia. Cultivated since ancient times. **A, B, F, G.** Numerous pomological forms: Arkansas, (Mammoth Black Twig), Baldwin, Bismarck, Summer White (Calville Blanc), Christmas Pearmana, Vaughan Pippin (Colonel Vaughan), Delicious, Duchess [of Oldenburg], Gladstone, Golden Delicious, Paroquet, Stayman Winesap, Sturmer Pippin, York Imperial. **H.**

Birch, Gray (*Betula populifolia* Marshall). N. E. N. Am. Smallest of the North American birches, this is a graceful but short-lived tree suitable for planting in dry poor soils or in boggy situations. The wood is used in the manufacture of small wooden-ware: spools, clothes-pins, etc. **B, C, H.**

Buckeye, described under "Large Trees" and "Large Shrubs."

Buckthorn, False or Woolly (*Bumelia lanuginosa* Persoon var. *oblongifolia* Clark). S. Mo. to E. Tex. With glossy leaves, stout thorns, and black berries. Flowers in mid-July. Grows on dry uplands and is very drought-resistant. Recommended as a hedge plant. [Bulletin, Dec. 1940]. **G, H.**

GOLDEN VARNISH TREE

(Koelreuteria paniculata)

CATALPA, JAPANESE (*Catalpa ovata* G. Don). China; cultivated in Japan. Introduced in 1849. With slender branches. The foliage is not so coarse in texture as the native catalpas. Yellow flowers in mid-June. **C.**

CATALPA, MANCHURIAN (*Catalpa Bungei* C. A. Meyer). N. China. Cultivated since 1877. Pyramidal tree apparently not so floriferous as other catalpas. Not to be confused with the Umbrella Catalpa of horticulture, which is a dwarf form of the Common Catalpa, *C. bignonioides* Walter. **G.**

CHERRY, EUROPEAN BIRD (*Prunus Padus* L.). Eurasia. Long in cultivation with numerous varieties. Resembles the May-tree. **F, G.**

CHERRY, WEEPING HIGAN (*Prunus subhirtella* Miquel var. *pendula* Tanaka). Japan. Introduced in 1862. The pale pink flowers bloom just as the leaves appear. **G.**

CHERRY, JAPANESE FLOWERING (*Prunus serrulata* Lindley). The original plant is a garden form (f. *albo-plena* Schneider) with white double flowers. There are three spontaneous varieties in eastern Asia. Blooms in April. **A, J, L.**

CHERRY, SWEET or MAZZARD (*Prunus avium* L.). Eurasia. Introduced into N. Am. about 1625. The wood is very close-grained and is valued in the manufacture of furniture, musical instruments, etc. **F, J.** Also commonly cultivated for its fruits in many pomological forms: BLACK TATARIAN, GOLD, MAY DUKE. **H.**

Cherry, Black, described under "Large Trees."

CHERRY, YAMA (*Prunus Sargentii* Rehder). Japan, Saghalin. Introduced in 1890. Hardiest and most vigorous of Japanese cherries. The flowers bloom before the leaves appear and are very showy. **F.**

Chittim-wood, see False Buckthorn.

CORKWOOD (*Leitneria floridana* Chapman). S. E. U. S. Prefers a moist soil. Increases by root suckers. The wood has a specific gravity of 18.1 lbs. per cu. ft., second lightest to Balsa-wood, *Ochroma Lagopus* Swartz, which is 7.3 lbs. per cu. ft. [BULLETIN, Aug. 1915]. Pistillate trees at **L.**

CRAB-APPLES, AMERICAN (*Malus*). E. U. S. With twiggy branches and large pink flowers that bloom a week or so later than the Oriental crabs. The fruits, which are rather large, yellowish-green and somewhat late in ripening, make excellent jelly. American crab-apples ought not to be planted near Red-cedars since the leaves are often badly discolored with orange blotches of the cedar-apple rust.

Prairie Crab (*M. ioensis* Britton). Minn. and Wisc. to Nebr., Kan. and Mo. **J.** The Bechtel's Crab (f. *plena* Rehder) is a very handsome double-flowered variety. **C.**

Wild Sweet Crab (*M. coronaria* Miller). N. Y. to Ala., west to Mo. **F, G, L.**

Crab-apples, Oriental (*Malus* species and hybrids). Cent. and E. Asia. With red, pink or white flowers in April and showy red or yellow dwarf apples in late summer and fall. The fruits, which sometimes persist on the branches long into the winter, are often sought by birds. They are also excellent for jelly. The Garden has about 25 varieties:

Arnold Crab (*Malus Arnoldiana* Sargent). **C, F, G.**

Carmine Crab (*M. atrosanguinea* Schneider). **C, F, G.**

Cherry Crab (*M. robusta* Rehder). **C, F.**

Chinese Flowering Crab (*M. spectabilis* Borkhausen). **C.**

Chinese Pearleaf Crab (*M. prunifolia* Borkhausen var. *Rinki* Rehder). **C.**

Cultivated Crab (*M. adstringens* Zabel): Hopa. **F, L;** Hyslop. **H;** Transcendent. **H.**

Dr. Van Fleet Crab. **C.**

Eley Crab (*M. purpurea* Rehder cl.* Eleyi Rehder). **C.**

Japanese Flowering Crab (*M. floribunda* Siebold). **C, F, L, N;** Peachblow. **C;** Snowbank. **C.**

Manchurian Crab (*M. baccata* Borkhausen var. *mandshurica* Schneider). **N.**

Midget or Kaido Crab (*M. micromalus* Makino). **C.**

Pearlear Crab, Yellow-fruited (*M. prunifolia* Borkhausen) Fructu-Lutea. **C.**

Purple Crab (*M. purpurea* Rehder). **L.**

Redbud Crab (*M. Zumi* Rehder cl. *calocarpa* Rehder). **N.**

Redvein Crab (*M. pumila* Miller var. *Niedzwetzkyana* Dieck). **F.**

Sargent Crab (*M. Sargenti* Rehder). **C.**

Scheidecker Crab (*M. Scheideckeri* Zabel). **F.**

Tea Crab (*M. hupehensis* Rehder). **C.**

Toringo Crab (*M. Sieboldii* Rehder). **F, N.**

Tree Toringo Crab (*M. Sieboldii* Rehder var. *arborescens* Rehder). **B.**

Dogwood, Flowering (*Cornus florida* L.). Ont., E. U. S. and Mex. One of the most handsome of North American trees with its gray bark and horizontal-spreading branches. Grows in rich, well-drained soil along banks of streams, often thriving in shade. Showy white petal-like bracts appear in late April. In the fall the upper surface of the leaves turns bright scarlet while the lower surface remains pale. The bright scarlet fruits are also attractive. **B, D, F, L.** The Pink-flowering Dogwood (var. *rubra* Weston) has pink or reddish bracts instead of white ones. **J.**

*cl. signifies clone, a group of plants propagated only by vegetative or asexual means.

ELM, GLOBE (*Ulmus carpinifolia* Gleditsch var. *umbraculifera* Rehder). Turkestan. Cultivated since 1879. A bushy tree with ascending branches and small leaves. Of formal appearance, useful for accent. **A, G, M, P.**

HAWTHORN *(Crataegus)*. This is the state flower of Missouri. The Downy Hawthorn, Red Haw or Thorn Apple (*C. mollis* Scheele) is the most widely distributed species throughout the state and is believed to be the one intended as the official flower. There are three specimens in the Garden (**J, L, M**), the largest one being northwest of the Iris Garden. A very attractive tree in bloom, the white flowers appearing amid the new leaves in late April and followed in late July by the rather large bright red fruit. Of the other species scattered about the Garden, especially noteworthy is the group which borders the Rose Garden on all but the north side. [BULLETIN, May 1923]. **General.**

HAWTHORN, ENGLISH (*Crataegus Oxyacantha* L.). Europe, N. Africa. Long in cultivation. This is the "May-tree" of English literature. Makes a fine-textured hedge. **D, H, L.**

Hawthorn, see also Thorn.

HOLLY, AMERICAN or WHITE (*Ilex opaca* Aiton). S. E. U. S. Broad-leaved evergreen that loses its foliage in St. Louis during the latter part of April. Very smoke-resistant. The bright red-berried branches are often used as Christmas decorations. When transplanting, it is necessary to defoliate at least two-thirds of the plant. [BULLETIN, Dec. 1915; Dec. 1920; May 1931]. **B, F, G, J, K, L, N.**

Hercules' Club, see Devil's Walking-stick.

HORSE-CHESTNUT, BAUMAN'S (*Aesculus Hippocastanum* L. f. *Baumanii* Schneider). A smaller tree than the species with white double flowers. **F.**

HORSE-CHESTNUT, RED (*Aesculus carnea* Hayne). Of hybrid origin, about 1818. **F.**

Judas-tree, see Redbud.

KATSURA-TREE (*Cercidiphyllum japonicum* Siebold & Zuccarini). Japan. Introduced in 1865. Prefers a moist soil, also a cooler climate than St. Louis. The botanical name means redbud-leaved tree of Japan, referring to the shape of the leaves. **L.**

LEATHERWOOD, SOUTHERN (*Cyrilla racemiflora* L.). Va. to Fla., also in the West Indies and E. S. Am. With graceful racemes of white flowers and bright green leaves turning orange and scarlet in the fall. **R.**

Locust, Black, described under "Large Trees."

MAPLE, AMUR (*Acer Ginnala* Maximowicz). E. Asia. Introduced about 1860. Slow-growing tree suitable for a hedge or screen. The reddish

fruit is conspicuous during the summer. The leaves turn bright red in the fall. **D, F, J, L, M.**

MAPLE, HEDGE (*Acer campestre* L.). Eurasia. With broad round head and small dull green leaves. Suitable for specimen planting, but less well adapted for a hedge than the preceding species. **F, H, I, J, M, N.**

MAYDAY-TREE (*Prunus Padus* L. var. *commutata* Dippel). E. Asia. Cultivated since 1890. The leaves of this tree are among the first to appear in mid-March and are followed in early April by long drooping racemes of white flowers. In the North the flowers bloom about a month later, hence the name "Mayday-tree;" not to be confused with the "May-tree," *Crataegus Oxyacantha* L., of English literature. **A, D,**

MOUNTAIN-ASH, EUROPEAN (*Sorbus aucuparia* L.). Eurasia. Long in cultivation and naturalized in N. Am. Handsome in the fall with its showy bright red fruits. Grows indifferently in the Midwest. **F.**

Oleaster, see Russian Olive.

OLIVE, RUSSIAN (*Elaeagnus angustifolia* L.). Eurasia. Long in cultivation. Conspicuous for its gray-green foliage. Useful as a hedge plant. **A, D, F, H, P.**

Pagoda-tree, Japanese, described under "Large Trees."

Paulownia, Royal, described under "Large Trees."

PAWPAW (*Asimina triloba* Dunal). E. and Cent. U. S. Commonly grows in thickets or sometimes scattered as an understory in the forests of rich bottom-lands. Curious dark purplish-brown flowers in late April or early May. The fleshy fruit, which resembles a banana, is nutritious and is considered delicious by some people. [BULLETIN, June 1916]. **M.**

PEACH, FLOWERING (*Prunus Persica* Batsch). China; in cultivation since ancient times, numerous horticultural varieties having been developed. Short-lived tree with showy single or double flowers and edible fruits. **A, B, D, F, I, M, Q.**

PEAR, CALLERY (*Pyrus Calleryana* Decaisne). China. Introduced in 1908. The fruit is small and not important horticulturally. **C, J.**

PEAR, COMMON (*Pyrus communis* L.). Eurasia. Long in cultivation; often naturalized. Numerous pomological varieties: DR. JULES GUYOT, JARGONNELLE, TRIOMPHE DE VIENNE, WINTER NELIS. **B, H.**

PEAR, USSURIAN (*Pyrus ussuriensis* Maximowicz). N. E. Asia. Introduced in 1855. Very conspicuous in bloom, with its numerous white flowers against the clear blue early April sky. **B, C, J.**

PINE, AUSTRIAN (*Pinus nigra* Arnold). Europe: Austria to Balkan Peninsula. Introduced in 1759. With long dark green needles, dark gray bark, and broad ovoid crown. Of vigorous growth. Most smoke-resistant

of conifers, being the only evergreen to survive from the original Henry Shaw pinetum. [BULLETIN, Nov. 1941] **B, D, G, K.**

PINE, SCOTS (*Pinus sylvestris* L.). Eurasia; naturalized in E. N. Am. Long in cultivation. One of the most important timber trees of Europe. A very desirable and hardy evergreen well adapted to the trying climatic conditions of St. Louis. [BULLETIN, Nov. 1941]. **M.**

PINE, WHITE (*Pinus Strobus* L.). Cent. E. N. Am. Important American timber tree and very ornamental with its bluish-green needles [BULLETIN, Nov. 1941]. **D, M.**

PLUM, GARDEN (*Prunus domestica* L.). Eurasia. Long in cultivation in many pomological forms: REINE CLAUDE [DE BARRY] (GREEN GAGE). **H.**

PLUM, JAPANESE (*Prunus salicina* Lindley). China; cultivated in Japan. Introduced in 1870. ABUNDANCE. **H.**

PLUM, WILD (*Prunus americana* Marshall). E. U. S. to Rocky Mts. Many pomological varieties are grown: OMAHA. **H.** Also planted for its white flowers in early April. **C.**

PLUM, WILD GOOSE (*Prunus Munsoniana* Wight & Hedrick). S. and Cent. U. S. The fruit are excellent for eating or jelly making. **Q.**

REDBUD, COMMON (*Cercis canadensis* L.). S. E. U. S. and No. Mex. This beautiful tree is a dominant note in the April landscape when its numerous bright pink buds appear on the naked black branches. It is effectively displayed against the evergreen foliage of the common Red-cedar. **General.** The double-flowering variety (var. *plena* Sudworth) blooms a week or so later than the species. [BULLETIN, May 1935]. **F.** For var. *alba* Rehder see "Whitebud."

RED-CEDAR (*Juniperus virginiana* L.). Cent. E. N. Am. Wide-spreading tree with very dense foliage when young. The heart-wood is reddish, durable and is used for fence-posts, lead-pencils, cedar-chests, etc. [BULLETIN, Feb. 1926; Nov. 1941]. **N.**

Rowan-tree, see European Mountain-Ash.

SILVERBELL, GREAT (*Halesia carolina* L.). S. E. U. S. Just as the young leaves are unfolding in late April, the white or creamy bell-shaped flowers are at their fullest, hanging in long rows from the branches. **L, M, N.**

SILVERBELL, TWO-WINGED (*Halesia diptera* Elliott). S. E. U. S. Similar to the preceding, but the fruits are 2- instead of 4-winged. Usually not so free flowering. **N.**

Snowdrop-tree, see Silverbell.

SPINDLE-TREE, EUROPEAN (*Euonymus europaea* L.). Eurasia; sometimes escaped in E. U. S. Long in cultivation. Ornamental in fruit. The foliage turns very deep red in fall. **F, M.**

THORN, WASHINGTON (*Crataegus Phaenopyrum* L.). S.E. U. S. Perhaps the most widely planted of any American species of hawthorn. Very striking in autumn with its large clusters of small orange fruits which persist and keep their color well into the winter. Said to have received its common name from the fact that early specimens were found near Washington, D. C. [BULLETIN, May 1923]. **A, C, D, J, L, M.**

Tulip-tree, described under "Large Trees."

Varnish-tree, Golden, described under "Large Trees."

WALKING-STICK, DEVIL'S (*Aralia spinosa* L.). Cent. and S. E. U. S. Small suckering tree whose stems are thickly beset with stout sharp spines. Feathery white flowers appear in late July. The compound leaves, which turn bright orange and yellow in the fall, are among the largest of any known plant. **A, C, D, F, N.**

WHITEBUD (*Cercis canadensis* L. f. *alba* Rehder). Originally grown in the nursery of John Teas, Carthage, Mo., this white-flowered form has recently been discovered in the wild. [BULLETIN, June 1922; April 1938]. **F, N.**

WILLOW, PUSSY or GLAUCOUS (*Salix discolor* Muhlenberg). N. E. N. Am. One of the first plants to flower in early spring. Its hairy catkins are familiar to little children. **B.**

Yellow-wood, described under "Large Trees."

LARGE SHRUBS

BAY, BULL (*Magnolia grandiflora* L.). S. E. U. S. A magnificent evergreen with large lustrous leaves and large fragrant white flowers appearing in late May and early June. Tender in St. Louis and requires a sheltered location. [BULLETIN, May 1922]. **M.**

BAY, SWEET or SWAMP (*Magnolia virginiana* L.). S. E. U. S. Attractive for its shiny dark green leaves glaucous on the under-surface. Small fragrant white flowers appear in late May and early June. [BULLETIN, May 1922]. **F, L.**

BUCKEYE, RED (*Aesculus Pavia* L.). S. E. U. S. The flowers are rather small but bright red. **N.**

BUCKTHORN, ALDER (*Rhamnus Frangula* L.). Eurasia, N. Africa; naturalized in N. E. and Cent. U. S. Long in cultivation. With numerous red to purple-black fruits in late summer and lustrous dark green leaves that turn clear yellow in November. Makes a distinctive hedge. **H, M, N.**

BUCKTHORN, COMMON or PURGING (*Rhamnus cathartica* L.). Eurasia; naturalized in E. U. S. Cultivated for centuries. Useful as a hedge plant. Its bark yields a medicine of strong cathartic properties: used also in making yellow dye. Sometimes called Hart's thorn, Waythorn and Rhine-berry. **General.**

BURNING-BUSH (*Euonymus atropurpurea* Jacquin). Cent. and S. E. U. S. The drooping purplish fruits contain blood-red seeds. **F.**

CHERRY, CORNELIAN (*Cornus mas* L.). Eurasia. Cultivated since ancient times. Its numerous tiny yellow flowers are among the first blossoms in the spring. The glossy leaves remain green late in the fall. Its edible plum-like fruits, although unpalatable when raw, make excellent jelly. [BULLETIN, Nov. 1922]. **B, F, M.**

CHINQUAPIN (*Castanea pumila* Miller). S. E. U. S. This unusual chestnut occurs on dry hillsides and uplands as well as rich bottom-lands. It flowers in early summer and the edible nuts ripen in September. [BULLETIN, Nov. 1926]. **N.**

EUONYMUS, WINGED (*Euonymus alata* Siebold). N. E. Asia. Introduced about 1860. Showy in the fall with its numerous brightly colored fruit and crimson leaves. Conspicuous in winter with its broadly winged branches. **A, L.**

EUONYMUS, YEDDO (*Euonymus yedoensis* Koehne). E. Asia. Introduced about 1865. Resembles the burning-bush. **F.**

Filbert, see Hazel.

FLAME-TREE (*Brachychiton acerifolium* Mueller). Australia. In St. Louis this species is very tender and rarely produces flowers. Notice the difference in habit of the specimen just inside the south door of the Floral Display House. **D, M.**

FRINGE-TREE, WHITE (*Chionanthus virginicus* L.). S. E. U. S. Striking in early May when covered with feathery white flowers; the staminate plant has larger blossoms but lacks the ornamental bluish fruit. The foliage is coarse-textured, dull green. Also called Old Man's Beard, Grandfather Graybeard, Snowflower-tree, and Flowering Ash. **A, D, F, N.**

HAZEL, AMERICAN (*Corylus americana* Marshall). E. N. Am. Cultivated for its rather coarse but handsome foliage. The nuts are edible. **N.**

HAZEL, EUROPEAN (*Corylus Avellana* L.). Europe. Long in cultivation for its edible nuts, called filberts. **O.** The PURPLE HAZEL (f. *fusco-rubra* Dippel) has dull purple or brownish-red leaves. **J.**

HORNBEAM, YEDDO (*Carpinus Tschonoskii* Maximowicz). N. E. Asia. Introduced in 1894. Cultivated for its foliage. Does not attain the arborescent proportions of other hornbeams that are grown in St. Louis. **A.**

HORSE-CHESTNUT, DWARF (*Aesculus parviflora* Walter). S. E. U. S. Valued for its showy white flowers in late June. **F.**

Juneberry, see Shad-bush.

Magnolia, Great Laurel, see Bull Bay.

MAGNOLIA, SAUCER (*Magnolia Soulangeana* Soulange-Bodin). Of hybrid origin, 1820. One of the most gorgeous early-flowering shrubs with its

large pink and white flowers. Blooms usually from late March to late April. [BULLETIN, March 1922]. **F, J.** The LENNÉ MAGNOLIA (cl. *Lennei* Rehder) has petals that are rosy purple outside and white inside. The flowers generally appear a week or so later than the Saucer Magnolia. **F.**

MAGNOLIA, STAR (*Magnolia stellata* L.). Japan. Introduced in 1862. Wide-spreading shrub with a profusion of fragrant white flowers from late March to late April. The delicate flowers are frequently injured by high winds, rain and frost. [BULLETIN, March 1922]. **F.**

MAGNOLIA, UMBRELLA (*Magnolia tripetala* L.). S. E. U. S. The flowers are surrounded by whorls of leaves, resembling umbrellas. [BULLETIN, March 1922]. **L.**

MAPLE, JAPANESE (*Acer palmatum* Thunberg). E. Asia. Introduced in 1820. Numerous forms varying in shape or coloration of leaves are cultivated. **M.**

Mimosa-tree, see Silk-tree.

MULBERRY, WEEPING (*Morus alba* L. f. *pendula* Dippel). Originated as a seedling in the nursery of John Teas, Carthage, Mo., about 1883. With long and slender pendulous branches and leaves usually lobed. The specimen at **J** is an ungrafted plant and sprawls vine-like over the ground.

OAK, WATER (*Quercus nigra* L.). S. E. U. S. A bottom-land species cultivated as a street tree in the South. Here, in drier soil and considerably north of its range, it scarcely attains a height of 6 feet. **K.**

PEA-TREE, SIBERIAN (*Caragana arborescens* Lamarck). N. E. Asia. Introduced in 1752. Much grown for hedges and shelter plantations in the Northwest. Yellow pea-like flowers appear in late April. **F, G, L.**

REDBUD, CHINESE (*Cercis chinensis* Bunge). Central China. Introduced before 1850. Very handsome in bloom with deeper rose-colored flowers than the common redbud. **F.**

Service-berry, see Shad-bush.

SHAD-BUSH or SHADBLOW (*Amelanchier canadensis* Medicus). E. U. S. It is a tradition that with the appearance of the pure white flowers of this plant in April the shad swim upstream to spawn. In June its juicy berries are eagerly sought by the birds. **C, J, N.**

SILK-TREE (*Albizzia Julibrissin* Durazzini). Persia to Cent. China. Introduced in 1745. Commonly called silk-tree on account of the silk-like tassels of pink flowers that bloom throughout July and August. One of the most graceful of large shrubs with its compound foliage. [BULLETIN, Sept. 1933]. **G.**

SMOKE-TREE (*Cotinus Coggygria* Scopoli). Eurasia. In cultivation since 1656. Planted for the plumose fruiting panicles in late May and early June and for the yellow and purple tints of the foliage in autumn. **F.**

Sterculea, Maple-leaved, see Flame-tree.

Sumac, Shining (*Rhus copallina* L.). Ont. and E. U. S. Planted for its lustrous leaves, changing to reddish-purple in the fall and for its crimson fruit clusters. **N.**

Sumac, Staghorn (*Rhus typhina* L.). S. E. Can. and N. E. and Cent. U. S. Grown for its leaves that turn brilliant scarlet and orange in early fall and for its crimson fruit clusters. **A, D, L.**

YELLOW-HORN
(Xanthoceras sorbifolia)

Sweet-Gum, Formosa (*Liquidambar formosana* Hance). E. Asia. Introduced in 1884. Tender; fails to reach arborescent proportions in St. Louis. **N.**

Tallow-tree, Chinese (*Sapium sebiferum* Roxburgh). China; naturalized in S. E. U. S. Cultivated since 1850. The waxy seed-coat is used for candles in China. Tender; rarely flowers in St. Louis. **B.**

Umbrella-tree, see Umbrella Magnolia.

Wahoo, see Burning-bush.

Witch-hazel, Common (*Hamamelis virginiana* L.). S. E. Can. and E. U. S. Spreading shrub with rather coarse-textured foliage which turns bright yellow at the same time that the small yellow flowers appear in the fall. **A.**

WITCH-HAZEL, VERNAL (*Hamamelis vernalis* Sargent). Mo. and Okla. to La. The flowers bloom in January and February and are less conspicuous but more fragrant than those of the preceding species. **F.**

YELLOW-HORN, SHINY-LEAF (*Xanthoceras sorbifolia* Bunge). N. China. Introduced in 1866. Its showy white flowers, more conspicuous than those of the Pearl-bush, open in mid-April. The lustrous leaves remain green until late in the fall. Well adapted to dry situations. [BULLETIN, May 1933]. **A, D, G, L.**

ROBERT B. CLARK.

NOTES

Lt. Robert B. Clark, formerly graduate student at the Garden and for the past year research assistant, has been granted a leave of absence to enter the Air Forces of the United States Army.

Mr. George H. Pring, Superintendent of the Garden, has published an article "Nymphaea colorata," in the July number of *Garden Glories* (**14**:7), the publication of the Garden Club of Illinois.

Mr. Leslie Hubricht, research assistant at the Garden, spoke at a joint meeting of the entomological section of the St. Louis Academy of Science and the Webster Groves Nature Study Society, September 11, on "Caves and Their Fauna."

Although the Veiled Prophet's Ball will not take place this year, the customary Queen's bouquet of Garden orchids was made up and presented to the former Queen after being shown at the Greater St. Louis Victory Garden Harvest Show, held at the Garden, October 2-4.

Mr. Ladislaus Cutak, in charge of Succulents at the Garden, has published the following papers recently: "Cacti as House Plants," in the May-June number of *Desert Plant Life* (**14**:92-93); "The Medicinal *Aloe vera*," in *The American Eagle* of September 17 (**37**: 1, 4); "Amateurs Prefer Mammillarias," in the October number of *Garden Life* (**15**:77).

Recent visitors to the Garden include: Mr. P. T. Haynes, Superintendent of Parks, Brownsville, Texas; Pvt. Louis G. Brenner, formerly graduate student at the Garden, now stationed at Portland, Oregon; Dr. C. L. Lundell, Research Professor in Botany and Curator of Herbarium, University of Michigan; Mr. Ralph Rawlings, formerly graduate student at the Garden.

STATISTICAL INFORMATION FOR SEPTEMBER, 1942

GARDEN ATTENDANCE:

Total number of visitors	20,256

PLANT ACCESSIONS:

Total number of plants and seed packets received as gifts	169

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought	10
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HERBARIUM ACCESSIONS:

By Purchase—

Heller, A. A.—Plants of Nevada, Arizona, and California	400

By Gift—

Anderson, E.—*Quercus cerris* L. from Horticulture	2
Hubricht, Leslie—Plants of Arkansas	20
James, Mrs. Arthur D.—*Gutierrezia dracunculoides* (DC.) Blake (*Amphiachrys dracunculoides* (DC.) Nutt.) from Kansas	1
James, Leslie—Plants of Alabama	6
Luttrell, E. S.—Lichens of Virginia	278
Mauldin, Mildred Pladek—Plants of Texas	51
Seibert, Russell J.—Plants chiefly from Florida	51
U. S. Plant Introduction Garden, Glendale, Maryland—*Matelea* sp. from Horticulture	1
von Schrenk, Hermann—Plants of Horticulture	10
Woodson, R. E.—*Selaginella* sp. from Horticulture	2

By Field Work—

Woodson, R. E.—Plants of Panama	526

By Transfer—

Clark, Robert B.—Cacti from Horticulture	3
Total	1,351

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Missouri Botanical Garden Bulletin

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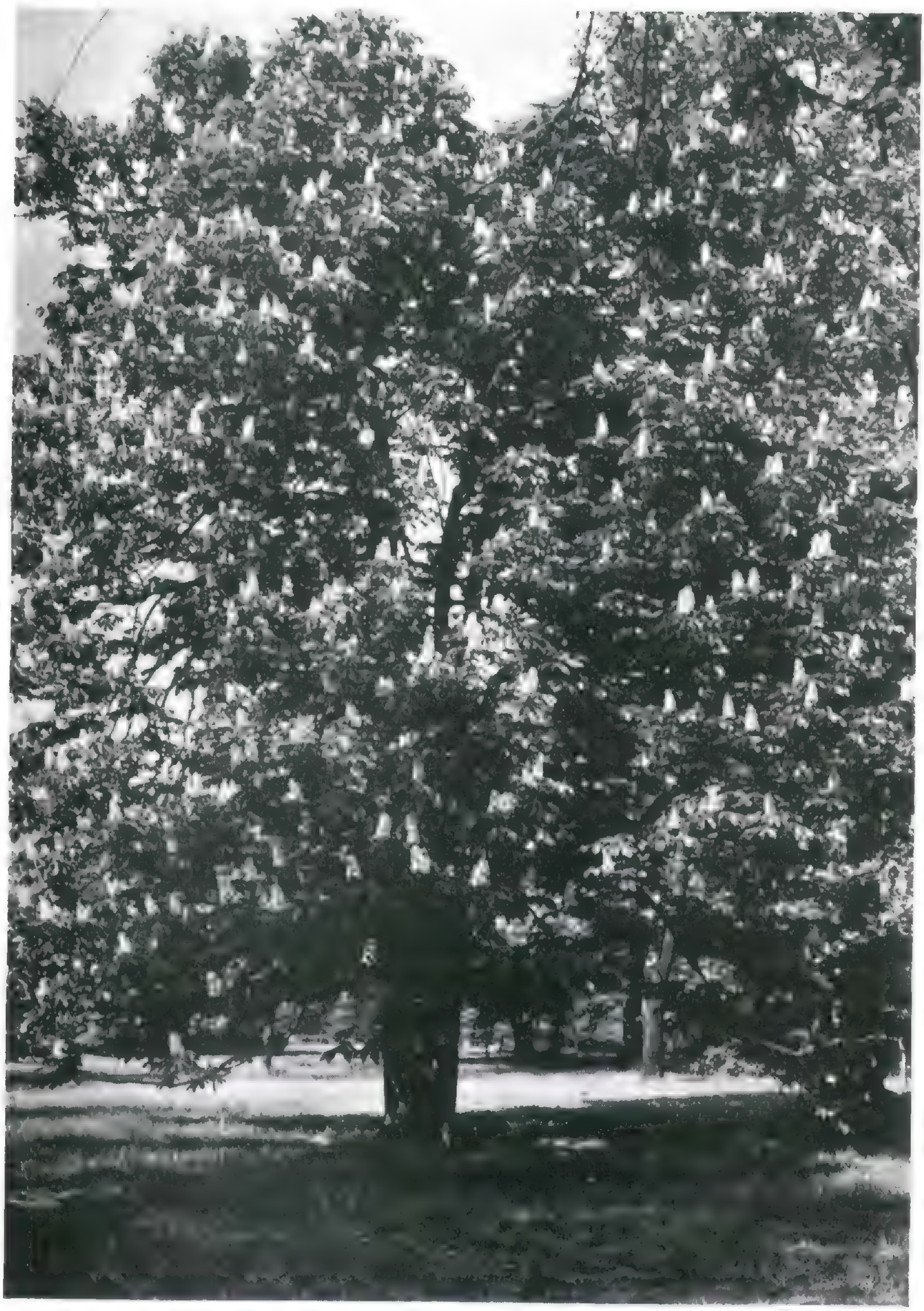
SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date until his death in 1889 it was maintained under his personal direction. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was chosen by Mr. Shaw and he definitely indicated that he wished it called by that name. The Garden passed at his death into the hands of a Board of Trustees, designated in Mr. Shaw's will, and the Board so constituted, exclusive of certain ex-officio members, is self perpetuating. By a further provision of the will the immediate direction of the Garden is vested in a Director, appointed by the Board. The Garden receives no support from city or state but is maintained almost exclusively from the estate left by Henry Shaw. Since 1939 many Garden Clubs and interested individuals have contributed to a "Friends of the Garden Fund" which is used in developing the new Arboretum, located at Gray Summit, Mo. The Arboretum (1) serves as a source of plants, trees and shrubs for the city Garden; (2) affords areas for gradually establishing a pinetum, a wild-flower reservation and various other features on a scale not possible in the city; (3) provides greenhouses for some 20,000 orchid plants.

The city Garden comprises 75 acres, where about 12,000 species of plants are grown, both out of doors and under glass. It is open every day in the year except New Year's Day and Christmas; week days, 8:00 a. m. until sunset; Sundays, 10:00 a. m. until sunset. The greenhouses are closed every day at 5:00 p. m.

The main entrance to the Garden is at Tower Grove Avenue and Flora Place, on the Sarah car line (No. 42). The Tower Grove bus (No. 21), direct from downtown, passes within three blocks of the main entrance.



THE HORSE CHESTNUT (*Aesculus Hippocastanum*)

Missouri Botanical Garden Bulletin

Vol. XXX NOVEMBER, 1942 No. 9

A NOTABLE GIFT TO THE MISSOURI BOTANICAL GARDEN

Through the generosity and public spirit of Mrs. Oscar Johnson, the Missouri Botanical Garden has had deeded to it a tract of about 150 acres of virgin land within easy reach of St. Louis. In addition, Mr. Fairfax Funsten has deeded about 10 acres needed to establish a satisfactory boundary to the south. This gift of Mrs. Johnson and Mr. Funsten constitutes one of the most notable contributions that could possibly be made at this time to the conservation of wild life in this region. The Garden regards it as both a privilege and a duty to assume the ownership and care of this area, a project which Henry Shaw would have welcomed as fulfilling one of the purposes in founding the Garden, and one which will be increasingly appreciated as the years go by. It will be maintained, as nearly as possible, as a natural reservation, a last remnant of what was at one time the finest and most beautiful example of the native flora of Missouri.

The tract is not only one of the few remaining bits of virgin forest in the neighborhood of St. Louis; it is a typical representative of an interesting and beautiful habitat which even in primitive times was comparatively rare. Paralleling the south bank of the Missouri River is a belt scarcely five miles wide, the so-called "loess belt", in which the top soil is rich and so fine that it holds the water during droughts longer than other kinds of soil. When the country was first opened up, this belt was clothed, except on the summits of the highest hills, with an unusually rich and beautiful forest. Even in primitive times the trees grew straighter and larger there than they did on the poorer and drier lands in the rest of the state, and on the north slopes in particular many northern species were able to survive during periods of drought. The very richness of these forests proved their undoing. They bore good timber which it was profitable to cut, and all but the very steepest and most remote valleys were potentially good farming land. Twenty years ago, by diligent hunting, one could find an occasional unspoiled remnant of this forest here and there at breaks in the Missouri river

cliffs, but to-day virtually all of these last refuges have been cut-over, or burned over, or so heavily pastured that the native vegetation is ruined.

This "Hidden Valley" was saved not only by Mrs. Johnson's intelligent interest but by the peculiarities of its topography. It is shaped like a steep-sided bowl with a narrow cleft on the side towards the Missouri River, and through this cleft runs the small creek which drains the area. All the public roads which approach the property are outside and well below the rim of the bowl. Along the railroad the northern rim of the bowl rises as almost vertical cliffs, except at the stream-crossing where there is marshy land which the railroad spans with a trestle. Fires, therefore, have not been able to spread into the tract; it has seldom been visited by thoughtless trespassers; and it has been too remote and too steep-sided to pasture or lumber profitably. Some years ago a small clearing was made near the mouth of the valley but it was soon abandoned and has grown up into a thick second-growth forest.

The bulk of the area is covered with a rich forest of sugar maple, white oak, and red oak, with a scattering of many other kinds of trees. As one climbs the hills the sugar maples drop out, particularly on the southern slope, and the ridge which forms the rim of the bowl is clothed with sturdy, short-trunked oaks and hickories.

Because of its beautiful trees the tract is interesting at any time of year but for six weeks in the spring it is absolutely unique. The commoner wild flowers of Missouri woodlands are there in abundance, many of them in unusual perfection because of the rich soil and the protection from marauding hogs (whose catastrophic effect upon the vegetation of the Ozarks is much more wide-spread and long-enduring than is generally realized). There are Spring-beauties and Solomon's Seal, Bellwort and Adder's-tongue, Jack-in-the-Pulpit and wild Sweet-William, all in abundance. What gives the tract its peculiar interest, however, is the presence, in enormous numbers, of plants which are either unknown or very rare elsewhere. Two of these deserve special mention, the large white Wake-Robin or Gleason's Trillium *(Trillium Gleasoni)*, and the Celandine Poppy *(Stylophorum diphyllum)*. Gleason's Trillium is not common as Trilliums go. It is something like the common white Trillium of the northern woodlands, though more imposing when in flower. It grows knee high, and its three big leaves are so broad that they join, making a green circular platter above which the pure white lily-like flower is delicately suspended. When undisturbed they form large clumps, and the leaves of one plant overlap those of the next, so that the little separate platters become parts of a wide, shiny green carpet with the flowers dancing above it. Ordinarily one counts it a privilege to see a few plants of this species. On the Johnson tract there are

thousands of them, and many are patriarch plants which form large clumps twenty feet and more across. The Celandine poppy is quite as conspicuous and even more prevalent on the tract. There are actually whole acres of woodland where one cannot step without treading on it. It has a lush light green foliage, orange-yellow flowers about the size of California poppies, like them too in having many golden stamens in the center. The blooms are borne abundantly over the top of the plant, and when in full flower they make a brilliant and beautiful mass of gold and green. Elsewhere in Missouri they are usually seen, if at all, as little patches of yellow and green here and there, but at Hidden Valley they make a most brilliant display, stretching away through the spring woodlands as far as the eye can see.

The peculiar bowl-like shape of the valley is valuable not only for the protection it gives the trees and smaller plants but also because it produces so many diverse habitats which greatly increase the number of native species. There are cool northern slopes with a rich deep soil. There are hot dry southern slopes with very thin soil, and there are exposed ledges with no soil at all which form interesting natural rock-gardens. While the tract is underlain by limestone the rim of the bowl has been leached for so many centuries that the resulting soil is acid and has species of plants which would not thrive in the "sweeter" soil of the lower woodlands. The little brook which drains the valley offers another series of habitats, and at the point where it is spanned by the railroad it expands into almost a marsh, attracting a number of species which do not grow elsewhere on the tract.

It is safe to say that there are few places in Missouri where so many different species of plants are found growing naturally on an area of this size, to say nothing of the immense number of plants of a few rare species.

NEW OR NOTEWORTHY PLANTS FOR ST. LOUIS. XIV

Vetch-leaf Sophora

In the May 1934 Bulletin appeared a note with illustration of the Pagoda Tree, *Sophora japonica*. Here it was stated that, "it remains in full leaf longer than any other large tree in the Garden. During the month of August it bears large clusters of cream-colored flowers of particular interest to nectar-loving insects. Thirty years of city residence have proven its hardiness, and during that time it has shown itself to be without a single objectionable habit as a city tree."

Now comes another Sophora which, while differing fundamentally from the Pagoda Tree, promises to be equally as valuable from the horticultural

VETCH-LEAF SOPHORA IN FULL FLOWER MAY 12, 1942.

standpoint. This is the Vetch-leaf Sophora (*Sophora viciifolia* Hance), introduced from western China in 1897. It has striking blue and white flowers, about an inch long, on the tips of short side branches. A good blue color in a shrub is rare, and if to its color is added a long blooming period a combination is presented which should not be overlooked. Belonging to the pod-bearing family, the flowers have the characteristic "sweet-pea" shape. The keel and wings are a snow-white and the standard a deep blue, and the colors never mingle but remain in strong contrast until the flower dries up. The flowers begin to appear about May 5 and persist for three weeks or longer.

The shrub is informal in habit, sparingly armed with spines, and has a tendency to spread. Eventually it may reach a height of seven or eight feet with a spread almost as great. The compound leaves may be two inches long, with as many as nineteen leaflets, and this accounts for the common name, Vetch-leaf Sophora.

The plant illustrated in plate 40 was grown from seed obtained in 1931, and flowered for the first time in 1942 when over four feet tall. There is evidence to indicate that it may have been injured by cold when younger, but it seems to have become hardier as it reached maturity. While reported to withstand dry weather, a real advantage in the neighborhood of St. Louis, and to favor sandy soil, our specimen has done very well in a very heavy soil without supplementary irrigation.

Experience indicates that the Vetch-leaf Sophora is reasonably free of insect pests and has no known diseases. In all respects it seems a reliable and worth-while addition to the woody plants of this region.

A. P. B.

FIVE-FINGERED SWAN-NECK ORCHID

(CYCNOCHES PENTADACTYLON)

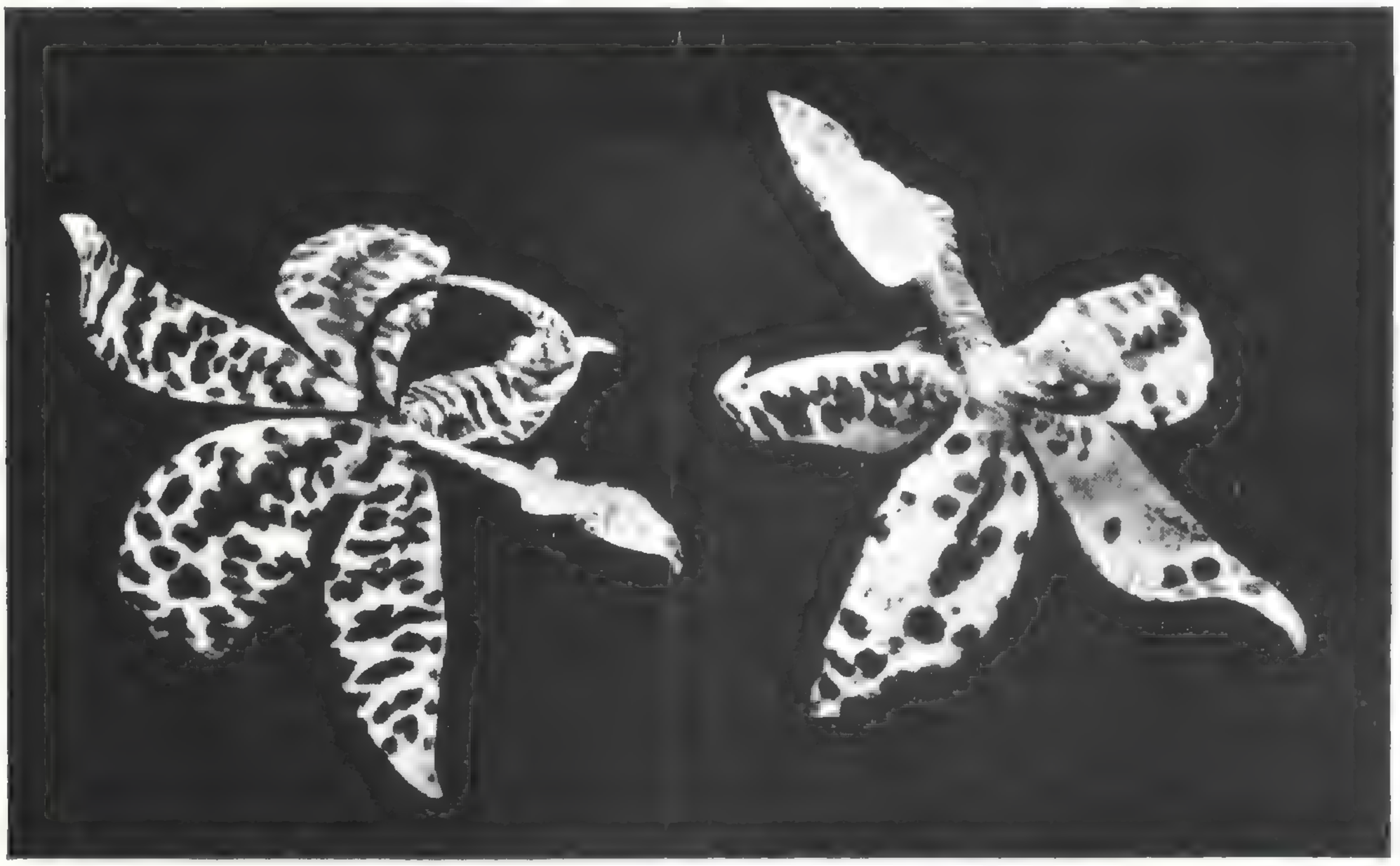
The genus Cycnoches, popularly called the Swan or Swan-neck Orchid, belongs to a group of orchid genera which has always been puzzling to botanists. The variation existing in this group and the resulting confusion is evidenced by the first description of the Five-fingered Swan-neck by Dr. John Lindley, noted orchidologist, in 1843 (*Edwards's Botanical Register*, vol. 6, pl. 22):—

"The fleshy-stemmed Orchidaceae, consisting of Catasetum, Cycnoches, Mormodes, and Cyrtopodium, probably form a group (Catasetidae), among which we find the most astonishing deviations from ordinary structure, and

FIVE-FINGERED SWAN-NECK *(Cycnoches pentadactylon)*

Showing one female flower (indicated by arrow) and seventeen male flowers on the same spike.

the most startling variations from what appears to be the rule in other parts of the organic world. If we were informed that the Camelopard in the Zoological Gardens had shortened the vertebrae of its neck till it was no longer than a cow's, or that a Kangaroo had exchanged its tail for the switch of a Shetland pony, a more surprising thing would not be announced than those changes with which we are now familiar in this group of Orchidaceae. . . . . All these things are here mentioned for the sake of shewing how difficult it is in such plants to judge correctly as to what may be a species and what a sport. Influenced by these considerations I have till lately refrained



FIVE-FINGERED SWAN-NECK ORCHID
Left, staminate or male flower; right, pistillate or female flower.

from saying anything about the plant now figured [pl. 22—illustration of *Cycnoches pentadactylon*]. It has in some respects so much the appearance of C. maculatum, that when I first received it from Mr. Veitch of Exeter, in March 1842, I hesitated whether to regard it as a variety or a distinct species . . . . . It has a short raceme of much larger greenish-yellow flowers, with broad chocolate-brown blotches, and its lip is quite remarkable, having 5 finger-like lobes and no more, instead of lateral comb-like fringes of C. maculatum."

The Garden specimen of *Cycnoches pentadactylon* was collected by Mr. M. B. Foster in Brazil and sent to us as an exchange in June, 1942. Much

of the early confusion in regard to the swan orchid is now explained by its unusual habit of producing exclusively either male or female spikes, and the Garden plant is of particular interest because both sexes are produced on the same spike. Plate 41 shows a spike of eighteen flowers, the terminal flower (indicated by arrow) overhung by the seventeen male flowers. An illustration of another swan orchid *(Cycnoches Warscewiczii)* having the male and female flowers on separate plants was given in the February 1931 Garden BULLETIN.

Description—Pseudobulbs horn-shaped, tapering towards the base, 1 foot high, 1 inch in diameter; old bulbs devoid of leaves, showing prominent leaf scars. Flowering bulbs carrying 10 alternate strap-shaped leaves gradually tapering to a point, decreasing in size towards the base, terminal leaves 1 foot long, 2½ inches wide. *Staminate flower:*—sepals and petals lance-shaped, green blotched with chocolate-brown; sepals 1½ inches long, ½ inch wide, petals slightly wider; lip with 3 prominent finger-like lobes and 2 sessile horns in front, green spotted chocolate-brown at the base, gradually tapering to a point; column curved, long, slender, chocolate-brown, green spotted with chocolate-brown towards the apex; anther-cap greenish-white faintly spotted with brown. *Pistillate flower:*—larger than the staminate flower, thicker in texture, less blotched and showing larger green areas; column twice as thick as that of the male flower, much shorter, ½ inch long, less curved and greener towards the stigmatic surface; lip three times larger than that of the male, possessing 1 horn or finger, green tipped with white, extending beyond an oblong-rounded ivory-colored lobe, thick, waxy, the lance-shaped lobe resembling the staminate flower.

G. H. P.

THE HORSE-CHESTNUT

A large horse-chestnut (*Aesculus Hippocastanum* L.) in full bloom in late April or early May is the most striking of flowering trees. The innumerable pyramids of white flowers, held erect at the tips of the upturned branches, light up the large, rich green leaves like so many candles (see pl. 39).

A mature horse-chestnut has a spread of some 40 to 50 feet and attains a height of 60 feet or more. Because of its large size it is a good subject for park and estate planting. Some trees have a single trunk, but more often several large, slightly spreading limbs develop near the base. By midsummer the fruits (sort of spiny burs) are fully grown, but they are not ripe until

October when they fall to the ground or are brought down by the squirrels. The seeds are large, measuring about 1½ inches across.

The horse-chestnut probably comes from Greece. The first known trees were cultivated in Constantinople, and from there they were sent to the various European countries in the last half of the sixteenth century. Matthiolus, in his "Compendium de Plantis," published in Venice in 1571, described the origin of the name "horse-chestnut" as follows: "The inhabitants of Constantinople call these chestnuts horse chestnuts, because they, when eaten, bring much relief to panting or coughing horses." In

Fig. 1. Flower of
Aesculus Hippocastanum Baumannii

Fig. 2. Fruit of
Aesculus Hippocastanum

1597, John Gerarde, in his "Herball or Generall Historie of Plantes," gives a similar description for the origin of the name: "called in England horse chestnuts; for the people of Eastern countries do with the fruit thereof cure their horses of the cough, shortness of breath, and such like diseases."

Parkinson in his "Paradisi in Sole Paradisus Terrestris," 1629, states that he planted the horse-chestnut in his orchard as a fruit tree between his walnuts and mulberries and that the fruits were sweet when roasted and eaten like the ordinary edible chestnut. According to Loudon ("Arboretum et Fruiticetum Britannicum," published in 1844), the word "Æ'sculus" is derived from *esca*, meaning nourishment, applied by Pliny to a species of oak

which had an edible acorn. The word Hippocastanum, from *hippos*, a horse, and *castanea*, a chestnut, is said by some to have been given to this tree ironically because the nuts resemble the sweet chestnut but are fit only for horses.

The horse-chestnut was introduced into America in 1741. This is recorded in an exchange of letters between John Bartram and Peter Collinson, as set forth in the "Memorials of John Bartram and Humphrey Marshall" by Darlington in 1849. The European representatives of the genus Aesculus are commonly called the horse-chestnuts while the American species are usually known as the buckeyes.

Aesculus Hippocastanum Baumannii is a variety of the common horse-

Fig. 3. *Aesculus parviflora* growing at the Garden.

chestnut which bears double, white flowers, but no seeds. A red-flowered horse-chestnut is *A. carnea*. This tree presumably is a hybrid between the common European horse-chestnut and *Aesculus Pavia*, a native of the southeastern part of the United States. Both these trees are considerably smaller than the common horse-chestnut and for that reason are more appropriate for planting in limited areas. They bloom in mid-May.

The last of the group to flower is *Aesculus parviflora*, the bottlebrush buckeye or dwarf horse-chestnut, which blooms in June. It is a broad, creeping shrub, six to ten feet high, a native of the southeastern states. Long, narrow spikes of white flowers with prominent stamens terminate the branches. There are other buckeyes native to the United States, particularly

worthy of mention being *A. glabra*, the Ohio buckeye, and *A. octandra*, the yellow buckeye.

All the common horse-chestnuts and buckeyes will grow in this locality. They are not particular about the soil but they do prefer an ample supply of moisture during the summer months. Fine specimens of the kinds described in this article may be found growing in the Missouri Botanical Garden.

P. A. K.

CANADIAN VERSUS CAROLINA HEMLOCK

The Hemlocks are a rather small group of conifers belonging to the genus Tsuga. Of the ten known species four are found within the United States: two from the West Coast—Mountain Hemlock (*Tsuga Mertensiana* Sarg.) and Western Hemlock (*Tsuga heterophylla* Sarg.); and two from the East Coast—Canadian Hemlock (*Tsuga canadensis* Carr.) and Carolina Hemlock (*Tsuga caroliniana* Engelm.).

The Pacific Coast species range from Alaska down the coast to northern California and inland to an elevation 7,000 feet above sea-level in Washington. Ten attempts have been made to grow these trees at the Arboretum, both from seeds and from young plants, but all attempts have ended in failure. It is quite possible that perfectly winter-hardy types can be found but thus far no plant has lasted throughout the summer. This is what might be expected from trees which are accustomed to sixty or more inches of rainfall annually when exposed to the dry hot summer of this region.

Between the years 1927 and 1932 six importations of the seed of two Asiatic species (*Tsuga Sieboldii* Carr. and *T. diversifolia* Mast.) were made. None of these attempts have produced a tree.

It will be seen, then, by the above process of elimination, that only the East Coast kinds are available for trial in Missouri. The Canadian or Common Hemlock is found growing from Michigan eastward to the Coast and southward from there to Georgia. Here at least is a Hemlock of wide distribution and one that might do well in this region. The Carolina Hemlock is a much less common tree, growing in the mountains from Virginia to Georgia, and we might assume that it was another species capable of withstanding a Missouri summer. Actually, however, since the first seeds and plants of Carolina Hemlocks were obtained in 1927 less than a dozen lived through the first summer. During that same period many Canadian Hemlocks have been grown and are doing well.

The largest and most attractive groups of Canadian Hemlock can be found on either side of the North Road in the Pinetum. These were purchased as seedlings from D. Hill Nursery Co., Dundee, Ill., in the spring of

1927. They were grown on for several years in the nursery, and then one-half the lot was planted on the south side of the road protected from the southwest by a low hill and a group of Pines, while the other half was planted north of the road and somewhat more exposed. Needless to say, those in the better position are larger and have suffered less loss than those on the north of the road. Additional seed shipments in subsequent years have nearly all yielded some plants. The scattered specimens along the Pinetum Lake and the group at the Lake spillway are from these seeds.

One thousand seedlings of the Carolina Hemlock were purchased from E. Gillett, Southwick, Mass., in the spring of 1927. None of these produced a tree. The latest shipment of one hundred seedlings was obtained from J. F. Norris, Doeville, Tenn., in the spring of 1941. At the present writing only five of these plants are alive. During the past fifteen years just as many Carolina as Canadian Hemlock seeds have been planted, but all the former have failed to grow past the first summer.

The loggers in the time of Paul Bunyan knew of two Canadian Hemlocks—the white and the red. The red is unknown to-day, and the evidence seems to indicate that certain very old trees did produce a heartwood darker than the rest. These were probably the "forest primeval" hemlocks "bearded with moss and in garments green." This too is a very accurate description of the habitat of the tree. A heavy growth of moss indicates a high and uniform humidity, and Hemlocks cannot be grown where the exposure to drying is great. The tree is very shade-tolerant. Seeds germinate and the seedlings make some growth even under the unbroken canopy of a hardwood forest, waiting for the chance to grow into the sunlight.

If we wish to grow Hemlocks in Missouri we shall have to be content with the Canadian variety, and even then provide shelter against the dry winds of summer. Also, the soil must not be allowed to dry. A good location would be to the north or northeast of a building, fence, or evergreen planting, and in a spot that remained moist for the greater part of the year. The beneficial effect of a location sheltered from the summer winds can be seen in the two Hemlock groups in the Pinetum. The group close to a ditch and sheltered by the Pines from the southwest are much larger than those from the same shipment planted in a more exposed location. Heavy mulching and fertilizing have improved the exposed group, but it is more satisfactory to plant Hemlocks in a damp place protected from the summer winds.

Little need be written about the value of the Hemlock in ornamental plantings except to point out that no other conifer has foliage as graceful; and that it is an addition to the landscape provided it is planted in a suitable location.

A. P. B.

NOTES

Mr. Ladislaus Cutak, in charge of Succulents at the Garden, gave an illustrated lecture "Introducing the Succulents", before the Henry Shaw Cactus Society, October 11.

Mr. George H. Pring, Superintendent of the Garden, spoke before the meeting of the Gravois Kiwanis Club of St. Louis County, November 4, on "The Missouri Botanical Garden", with special emphasis on plants of priority.

Recent visitors to the Garden include Mr. Russell J. Seibert, Agent Rubber Investigations, U. S. Bureau of Plant Industry, Washington, D. C.; Miss Allen, Assistant in the Herbarium, Cornell University, Ithaca, New York; Dr. and Mrs. George Neville Jones, the former, Assistant Professor of Botany, University of Illinois, Urbana; Mrs. Leighton R. Cornman, a dahlia breeder and fern enthusiast, of Cardiff-by-the-Sea, California.

The China-Fir Tree in Missouri: While on a collecting trip in southern Missouri, Dr. Anderson and Mr. Beilmann were surprised to see a China-Fir tree *(Cunninghamia lanceolata)* growing in front yard of a house in St. Mary's, Missouri. Cunninghamia is a handsome evergreen, one of the conifers, with large, flat, sharp-pointed needles and somewhat pendulous branches. While it does fairly well on the Pacific Coast as far north as Vancouver, in the East it is not supposed to be hardy much north of Memphis, Tenn. However, according to Rehder, it grows in Pennsylvania in sheltered positions and it has done well in the northern Shenandoah Valley. The St. Mary's tree is about 15 feet high and in excellent condition although it has been badly injured in severe winters. It is located at the base of a hill which shelters it from the north and west, and the soil is excellent for coniferous trees.

STATISTICAL INFORMATION FOR OCTOBER, 1942

GARDEN ATTENDANCE:

Total number of visitors	21,782

PLANT ACCESSIONS:

Total number of plants and seed packets received as gifts	3

LIBRARY ACCESSIONS:

Total number of books bought	11
Total number of books and pamphlets donated	188

HERBARIUM ACCESSIONS:

By Gift—

Allen, Paul A.—Plants of Panama	30
Anderson, E.—Plants of Horticulture	12
Anderson, E.—Plants of Virginia and West Virginia	11
Cornman, Mrs. Leighton R.—Lichens, hepatics, and mosses of Panama	122
Finklenberg, Miss—*Polyporus* sp. from Missouri	1
Hayden, Ada—Plants of Iowa	23
Heising, Miss Clara—*Carissa grandiflora* DC. from Florida	1
Hubricht, Leslie—Plants of Illinois and Missouri	17
James, Leslie—Plants of Alabama	10
Rose, Lewis Samuel—Plants of California	118
Shirley, A. E.—*Quercus runcinata* Engelm.—a hybrid oak from Hyde Park, Kansas City, Missouri	1

By Transfer—

Cutak, Ladislaus—Cactus from Horticulture	1
Pring, George H.—*Cycnoches pentadactylon* Lindl. from Horticulture	1
	348

STAFF
OF THE MISSOURI BOTANICAL GARDEN

THE GARDEN, 2315 TOWER GROVE AVENUE, ST. LOUIS, MISSOURI

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"Should be of great use to local garden clubs, and for the scientific worker who is concerned with the local flora it should be invaluable."

National Horticultural Magazine

"Carefully and critically done, so that it should find wide and enthusiastic reception at the hands of all who enjoy being acquainted with the rich native flora of Missouri."

Rhodora

"The most comprehensive spring flora ever issued for any state. . . . Notable for presenting its data in simple non-technical English, yet with thorough scientific accuracy. Book's value not limited to Missouri."

Field Museum Notes

For sale by the Missouri Botanical Garden. Price $3.00

Missouri Botanical Garden Bulletin

Vol. XXX DECEMBER, 1942 No. 10

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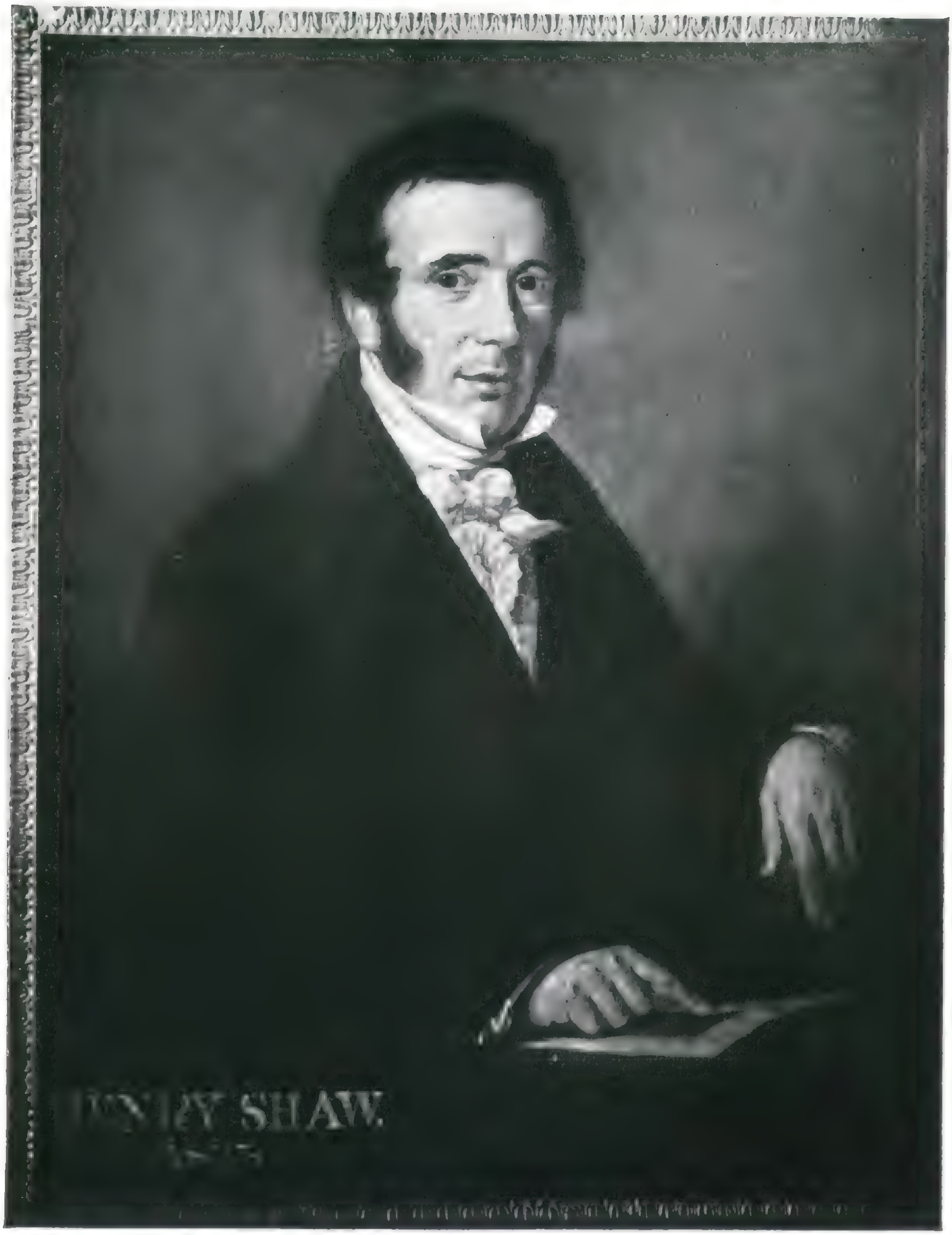
SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date until his death in 1889 it was maintained under his personal direction. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was chosen by Mr. Shaw and he definitely indicated that he wished it called by that name. The Garden passed at his death into the hands of a Board of Trustees, designated in Mr. Shaw's will, and the Board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will the immediate direction of the Garden is vested in a Director, appointed by the Board. The Garden receives no support from city or state but is maintained almost exclusively from the estate left by Henry Shaw. Since 1939 many Garden Clubs and interested individuals have contributed to a "Friends of the Garden Fund" which is used in developing the new Arboretum, located at Gray Summit, Mo. The Arboretum (1) serves as a source of plants, trees and shrubs for the city Garden; (2) affords areas for gradually establishing a pinetum, a wild-flower reservation and various other features on a scale not possible in the city; (3) provides greenhouses for some 20,000 orchid plants.

The city Garden comprises 75 acres, where about 12,000 species of plants are grown, both out of doors and under glass. It is open every day in the year except New Year's Day and Christmas; week days, 8:00 a. m. until sunset; Sundays, 10:00 a. m. until sunset. The greenhouses are closed every day at 5:00 p. m.

The main entrance to the Garden is at Tower Grove and Flora Place, on the Sarah car line (No. 42). The Tower Grove bus (No. 21), direct from downtown, passes within three blocks of the main entrance.


JOSIAH SHAW.

Missouri Botanical Garden Bulletin

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A TOUR OF THE MISSOURI BOTANICAL GARDEN

We are often asked, "What is a botanical garden anyway? Is it a park, and if so why not call it that?" In answer, it may be said that a botanical garden may sometimes look like a park, but it is much more than that. It is a place for collections of different kinds of plants, for information about plants, and a laboratory for studying and publishing the results. One phase of its work is to arrange displays for the delight and instruction of the general public. While there is always something to see at the Missouri Botanical Garden, there are also special displays at certain seasons both out of doors and under glass. In addition there are a number of important features which are not ordinarily open to the general public. These include: (1) a large botanical library and herbarium, (A) on map; (2) a laboratory for graduate students; (3) the editorial office; and (4) an experimental greenhouse where, among other things, orchids are raised from seed.

The GARDEN is hidden away from the outside world by sturdy old-fashioned limestone walls, so high that the passer-by catches only tantalizing glimpses of tree tops or of vines which spill down over the gray-white stones. One enters through the **Main Gate (1)*** on Tower Grove Avenue, opposite the appropriately named Flora Place. The original entrance has had to make way for a more commodious building, but the architect has been able to preserve much of the spirit of the original and still make provision for the hundreds of thousands of visitors who every year pass through the cheerfully clicking turnstiles. Over the entrance can be seen the quaintly lettered stone taken from the original gate. It bears the official designation selected by Henry Shaw, "Missouri Botanical Garden," and the date of its erection, 1858.

Immediately before the entrance stretch the **Tropical Lily Pools (2)**. From July until frost these contain the finest display of tropical water-lilies ever brought together. In the early morning and late afternoon and on cool, damp days the night-blooming

*The numbers and letters in parentheses indicate the locations on the Garden map opposite page 218.

MAIN GREENHOUSE AND TROPICAL LILY POOLS

water-lilies hold the stage with their large, waxy petals of pink and white. All of these varieties have been developed at the Garden, the pure white "Missouri," the pink variety "Mrs. George C. Hitchcock," and the darker red "Frank Trelease." The Garden is justly proud of these introductions but the glory of the display is the newer and less commonly grown day-blooming, tropical hybrids. These magnificent flowers, wider than dinner-plates and in exquisite shades of yellow, pink, lavender, and blue, have largely been developed at the Missouri Botanical Garden. Out-

GIANT AND PYGMY WATER-LILIES
(Nymphaea "Missouri" and *N. tetragona)*

standing among the varieties produced here are "Mrs. G. H. Pring," with very large flowers of pure white; the pale-pink, large-flowered "General Pershing"; "Mrs. Edwards Whitaker," with enormous flower petals of soft lavender-blue cupped around the golden stamens in the center; and most interesting of all, the hybrid yellow lily, "Saint Louis." After the earlier varieties had been originated, the Garden sought to extend the color range to other shades besides the original pinks, blues, and whites. The only possibility of obtaining a new "break," as the plant breeders say, seemed to be through the introduction of a species with bright yellow flowers which was known to be native to the muddy ponds

of equatorial Africa. It was not in cultivation and only after a series of unsuccessful attempts was the Garden able to procure this "lost yellow lily" for its collection. The species itself proved disappointingly difficult to grow, but from it by cross-breeding there has been obtained a whole new series of water-lilies. The variety "Saint Louis" (U. S. Plant Patent No. 55) has large, handsomely shaped flowers of an attractive shade of light yellow which forms a pleasing contrast to the pinks and blues of the older varieties. "African Gold" is a brighter and deeper yellow. "Talisman" has the basic yellow strongly flushed with pink as in the rose variety of that name. In the big central pool the giant water-platter *(Victoria Regia)* spreads its enormous leaves. Their margins are turned up into a stiff rim, and the leaf is buttressed with an intricate framework of cross-connecting veins. Large leaves are strong enough to support the weight of a child.

THE ROSE GARDEN

To the right of the Lily Pools a shrub-bordered pathway leads to the **Rose Garden (3)**, at its loveliest in May and June but attractive at all times of the year by reason of its excellent design. The center of the Rose Garden is a converging point for all the main pathways in this part of the Garden, and in whichever direction one looks the pathway frames a view. To the west is the shrub-bordered walk ending in the arched entrance to the Floral Display

THE VEILED PROPHET QUEEN'S ORCHID BOUQUET

House. The adjoining pathway shows at its terminus a pleasing glimpse of the dignified, white pillars of the Palm House. Particularly noteworthy is the treatment of the vista to the south. In this direction one looks down rose-bordered stretches of turf to the perennial and shrub gardens of the Knolls and sees in the distance the square, white tower of Mr. Shaw's old home, "Tower

Grove." By a clever technical trick the landscape architect has caused the water-lily pools and their attendant walks to be lowered just enough so that they are not visible from the Rose Garden, thus preventing a discordant cross-wise streak through the center of the picture.

In the opposite direction is the **Linnean House** (4), the only remaining greenhouse which was erected in Mr. Shaw's day. It is so named because it bears over its main entrance portrait busts of three outstanding naturalists, Nuttall at one side, Asa Gray at the other, and crowning the gable, the great Swedish botanist, Linnaeus. A tablet high overhead informs us that the building

THE LINNEAN GARDEN

was formally dedicated in 1881, "to Linnaeus the Prince of Nature," by Dr. George Engelmann, one of the greatest botanists of his day, a German emigré who made his home in St. Louis and was the close friend of Henry Shaw. The building itself is interesting as one of the few remaining examples of middle nineteenth century greenhouses. Compared to a modern greenhouse there is much more brick and much less glass, and there are intricate fanlights over the doorways. The Linnean House is filled with a collection of camellias, genistas, and other winter-flowering shrubs, planted to simulate an outdoor garden, and from January to March is a continuous bower of blossom.

A CHRYSANTHEMUM SHOW

A HYBRID ORCHID
Dendrobium fimbriatum var. *oculatum*

Around the Linnean House on three sides extends the **Linnean Garden (5)**, largely of perennials. Particularly to be noted here is an unusually fine specimen of the sweet bay, *Magnolia virginiana,*" which shades the center of the east garden. Its glossy leaves remain late in the fall and in late May or early June its creamy white flowers fill the air with their heavy tropical scent.

One can pass directly from the Rose Garden to the **Floral Display House** (6) or go by way of the gate in the west wall of the Linnean Garden and down a curving flagstone path through the shrubbery. As its name indicates, this house is used for big displays or flower shows which are staged from November to April.

DANCING GIRL ORCHIDS
Flowers of *Oncidium stipitatum* arranged as a ballet

JUNGLE SCENE IN ORCHID SHOW

Highest in popular favor are usually the Chrysanthemum Show, in the fall, and the Orchid Show, shortly after Christmas, which often bring more than ten thousand visitors in a single day. The Garden is nationally known for its orchids which are exhibited *en masse* during the Orchid Show and are always on display at other times of the year in the range of houses beyond the Floral Display House. Over 10,000 blooms are displayed in the course of a year. Starting with the gift of the D. S. Brown orchids in 1918 the collection was greatly augmented through special trips made in South and Central America by Mr. G. H. Pring.

More recently the Garden has undertaken the breeding and culture of orchid hybrids, a process of such great technical difficulty that it is seldom attempted. After the cross is made and the tiny, powder-like seed has been sown in hermetically sealed glass incubators, there must be 5 to 7 years of watchful care before the hybrids are brought to flowering size. From the gelatin mixture on which they are first artificially nourished they must be transplanted into tiny flower-pots scarcely larger than a thimble, and from these gradually stepped up into larger and larger containers, all this time requiring daily care. The first of these hybrids reached flowering age in 1934 and by their size and brilliance justified the years of painstaking effort which had gone into their production.

Orchids do not thrive under city conditions, and the Garden has a whole range of orchid houses at the Arboretum, Gray Summit, Missouri, at the junction of Highways 66 and 50. There the orchids are grown, some 25,000 plants of them, and are brought into the city Garden for display purposes. There also is a pinetum and a wild-flower garden. There are acres of daffodils, a collection of Oriental flowering crabapples, all of these reached by a winding drive of approximately two miles in length. The Arboretum is gradually being developed as an adjunct to the city Garden.

From the upper court of the Floral Display House one can pass to either of two greenhouses on a lower level, the **Citrus House** (7) and the **Aroid House** (8), which are in reality one big greenhouse separated by a wall. At their western end one turns to the right through the **Bromeliad House** (9). Here will be seen large specimens of the stilt plant, Pandanus, often grown in a very dwarfed condition in flower boxes but here developing as it does in the tropics, held high above the ground on strong roots or "stilts." As the name would imply, this house also contains a fine collection of Bromeliads, curious plants with queer, brightly colored flowers. Most of them are tropical and are ordinarily found growing in tree tops, nourished by the water which collects at the base of the

PITCHER PLANT *(Nepenthes Dicksoniana)*

leaves. Many of the Bromeliads in this collection will be seen to be more or less funnel-shaped and there is usually water in the "funnel," justifying the popular name of "tank plant." A few of the plants in this family have a somewhat different aspect, notably the pineapple and the Spanish moss or "Santa Claus's whiskers."

We pass on into the **Plant Curiosities House** (10), a veri-

table garden of freaks, a "believe-it-or-not" greenhouse in which have been brought together plant oddities from all over the world. Here will be found the parachute flowers, the artillery plant which shoots its seeds, the climbing onion, and the mother-in-law's tongue, the rat-tail plant, the dumb cane (if one bites the leaves the tongue swells so that speech is impossible), the babes-in-the-cradle, and the tropical pitcher-plants which, at the tips of their long leaves, bear cunningly designed traps for unwary insects.

We may reach the main range of greenhouses either by retracing our steps to the Floral Display House or by leaving through the west door of the Citrus and Aroid House. In the summer this latter is the more interesting route, particularly when the sacred pink lotus of India is in bloom in the **Lotus Pond** (11) just at the right. At the left a walk leads us by the collection of **Rock Plants** and **Hardy water-lilies** (12) to the **Herb Garden** (13). Here a few medicinal herbs and such of the culinary herbs as can be grown out of doors in this climate are cultivated in trim beds, with complete labels telling the main purposes for which each plant is used. To many visitors this is one of the most interesting parts of the Garden. There are many plants here which one has smelled or tasted but never seen growing: dill, anise, rosemary, lavender.

From the Herb Garden we can enter the Pergola by either end or by climbing the flight of steps in the central archway. It forms a pleasantly shaded terrace from which to view the **Italian Garden** (14), a formal arrangement of flower beds in a precise geometrical pattern, centered about a statue of Juno which Mr. Shaw imported from Italy, the original being in the National Museum at Naples. Instead of boxwood which is the traditional hedge plant for such gardens, a hardier shrub has had to be used because of the climate. By keeping it low and by careful and frequent shearing the common California privet has been made into an effective substitute.

To the left of the terrace will be seen the brilliant metallic leaves of the copper beech, a particularly fine specimen of a variety of the common European beech. In the distance rise the slender spires of the bald cypress, native to the deep swamps of the South.

Crossing the Italian Garden at the left we begin the circuit of the Main Greenhouses. We first pass **Coffee Plants** (15), large bushes with fine glossy leaves, white flowers, and dark-red berries. At the further end of the same greenhouse is a collection of **South African Plants** (16), distinguished by their strikingly grotesque forms. Growing as they do in desert regions where rainfall is scarce and where high temperatures prevail, they have adjusted

AZALEA SHOW

POINSETTIA SHOW

ITALIAN GARDEN

themselves to these peculiar conditions. They all possess thickened leaves and stems in which water is stored; upon this reservoir the plant relies in times of drought. To safeguard the water supply, they are provided with an impervious layer which covers the entire surface. Among the interesting desert dwellers gathered here are the aloes, native to Africa or to its outlying islands. Some species attain the size of large trees but the great majority are low-growing. From certain species is extracted the "bitter aloe" of commerce. Another conspicuous group of plants is the mesembryanthemums. Some of these have thick, tongue-shaped leaves; others are peculiarly constructed so that they somewhat resemble miniature jaws; still others are of the rambling type, making mats of green and blue and in season producing daisy-like blossoms of yellow, orange, red, white, rose, or purple. The wax plant, *Hoya carnosa*, with its shining, succulent leaves, is seen twining about an improvised trellis. When in bloom, its handsome wax-like flowers make this old-time favorite even more lovely.

A short flight of steps leads into the **Fern and Cycad House (17)**. Here are to be found tropical ferns though city conditions make it difficult to grow some of the more beautiful species. There is, however, a really fine collection of the curious plants known as Cycads. These are an ancient type, much more common in former periods of the earth's history than they are now. Superficially, many of them look like palms but most botanists consider them a sort of missing link between the ferns and the flowering plants. Certain African species are used as food by the natives and are known as "Kaffir bread." One of the common Japanese species, *Cycas revoluta*, the sago plant, has beautiful palm-like leaves which are dried and shipped to this country where they are largely used in making memorial wreaths and similar decorations. Growing along the girders of this greenhouse is an interesting tropical grape, *Cissus sicyoides* var. *Jacquini*. From the axils of its leaves there arise thread-like roots which grow down until they reach the soil far below. Those successful enough to find a good roothold then thicken considerably and serve as an additional supply of food and water for the leaves overhead.

The central portion of the Main Greenhouses is largely given over to **Palms (18)**. Here will be found among others the date palm, the oil palm (which supplies the palm oil used in the manufacture of soap), the sugar palm, a source of sugar and also largely used in the tropics in the manufacture of palm wine, and the Chinese fan palm, which supplies both the common palm-leaf fans and the equally common strips of leaf for Palm Sunday. One of

BULB SHOW

HINDU LOTUS (NELUMBO)

the most interesting of the palms will be found here, the tagua palm, *Phytelephas macrocarpa*, whose heavy white seeds are the so-called vegetable ivory used in the manufacture of buttons and other small ornaments. From either of the porticos of the Palm House there are vistas so beautiful that most visitors will wish to step out for a moment and enjoy them. To the right the west portico looks down on the Italian Garden with its brightly patterned flower-beds, its beautiful old statue, and its tinkling wall fountain. To the left, the east portico looks back down the lily pools to the Main Gate.

Continuing through the greenhouses we come to the **Economic House** (19) where a number of tropical plants of great economic importance are grown: perfume plants, rubbers, tropical fruits, such as the mango and the avocado pear, the tung-oil tree *(Aleurites)*, the Balsa tree whose timbers are seven times lighter than cork, the chicle tree, *Achras Sapota*, from whose sap our common chewing-gum is manufactured, and the kapok tree whose silky seeds are made into mattresses and life-preservers. From the other end of this house a flight of steps leads us down to the main collection of **Cacti and Succulent Plants** (20). Here will be seen some of the most bizarre and grotesque forms of the plant world, such as the agaves or century plants which provided the Aztecs with food, drink, clothing, and writing materials. From the

DESERT HOUSE

The Missouri Botanical Garden has the most comprehensive collection of desert plants under glass.

NIGHT-BLOOMING CEREUS
(Selenicereus pteranthus)

sap an intoxicating drink, "pulque," was fermented; the cores were roasted and eaten; the leaves were used as roofing thatch, and the thorns were used for pins and needles. On the right is a group of plants looking so much like real dumplings that one could almost eat them. However, should one do so strange color visions would pass before the eyes for this is the "peyote" of the southwestern Indians, from time immemorial used by them in their religious rituals. The barrel cactus, another interesting plant of the desert, yields a sufficient amount of water from its inner pulp to have proved a life saver for many a heat-crazed traveler on our American

ECONOMIC GARDEN SHOWING ESPALIERED FRUIT TREES ON EACH SIDE OF PATH

deserts. The "saguaro," largest and stateliest of the cacti, is also represented in the collection. Nearing the exit door, the carrion flowers, known botanically as Stapelias, will attract our attention. These cactus-like plants are really closely related to the milkweeds and have beautiful, star-like flowers, but unfortunately they emit an unpleasant fetid odor which attracts the flies, the pollinating agents for these curious plants. The euphorbias, or spurges, also occupy a prominent place in the rear part of the house. These interesting African succulents simulate the cacti in all outward appearances and yet there is no close relationship.

Again we walk through the corner of the Italian Garden and up to the shaded brick terrace of the pergola. To the left, a broad gravel path leads us to the **Economic Garden (21)**, really a succession of little gardens on a series of terraces, with a central pathway shaded by espaliered trees. This method of training fruit trees over a trellis is very commonly practiced in northern Europe, where the summers are so short and cool that apples and peaches need all the available sunshine if they are to be ripened to perfection. In our hot, sunny climate the method is more interesting than useful, but the arches lend an old-world atmosphere to the garden and shade the walk effectively. On several of the terraces important or interesting crop plants are grown in small demonstration beds. Here will be found cotton, flax, corn, broom-corn, upland rice, peanuts, clover, field-peas, and such unusual crops as ramie (Chinese silk linen), unicorn plant, and udo, the Japanese substitute for asparagus. On the central terrace are four back-yard gardens, plots the size and shape of a city back-yard, demonstrating what can be done with such an area under city conditions. Particularly notable is the first one to the left, planted as a city rose garden. In design and execution it is a little masterpiece and has received favorable comment from leading rosarians as an example of what can be done with roses under very difficult conditions. On another terrace will be found a collection of ornamental grasses which are hardy in this climate.

Continuing down the central pathway we pass a small pool which terminates the Economic Garden and we catch glimpses of the **Iris Garden (22)** ahead. Over a thousand varieties of bearded irises have been brought together in one large planting, and from late April to the middle of May it is the most colorful spot in the Garden.

Beyond the Iris Garden rises the brick **Administration Building (A)** containing the library, offices, and herbarium, and close at hand is the **Experimental Greenhouse (D)**, neither of these buildings being open to the public. The north end of the Administration Building was once Mr. Shaw's city home at Seventh and Locust streets in what is now downtown St. Louis. It was moved to this site in accordance with the provisions of his will and with subsequent additions it houses the Botanical Library founded by Mr. Shaw, the Scientific Laboratories, and the Herbarium, or collection of dried specimens of plants. It is here that work of scientific discovery is carried on, as Mr. Shaw had directed it should be. He would be proud to know that by reason of this work his Garden has made a name for itself throughout the scientific world.

HENRY SHAW'S OLD RESIDENCE

IRIS GARDEN

We have now reached the **"Old Residence" (23)**, "Tower Grove," which Henry Shaw built for a country home in 1849. A part of the lower floor is open to the public on rare occasions. The old-fashioned rooms with their high ceilings and marble fire-places form an effective background in which are displayed portraits of Henry Shaw, various articles belonging to him, and documents relating to him and to the Garden.

He was a native of England who came to St. Louis in 1819 and in a few decades amassed a comfortable fortune. He then retired from business, travelled widely, and developed his country estate until it became a real Botanical Garden. Not only did he grow choice collections of plants but he commissioned his friend, Dr. George Engelmann, to purchase the books and herbarium specimens which were the foundation of these collections. He built a Museum to house them, a quaint red-brick building which will be seen just to the right as one leaves Mr. Shaw's old residence. The **Museum (E)** is not ordinarily open to the public, but it has been fitted up as an auditorium and is used as a meeting place for horticultural and botanical societies and for lectures to the general public.

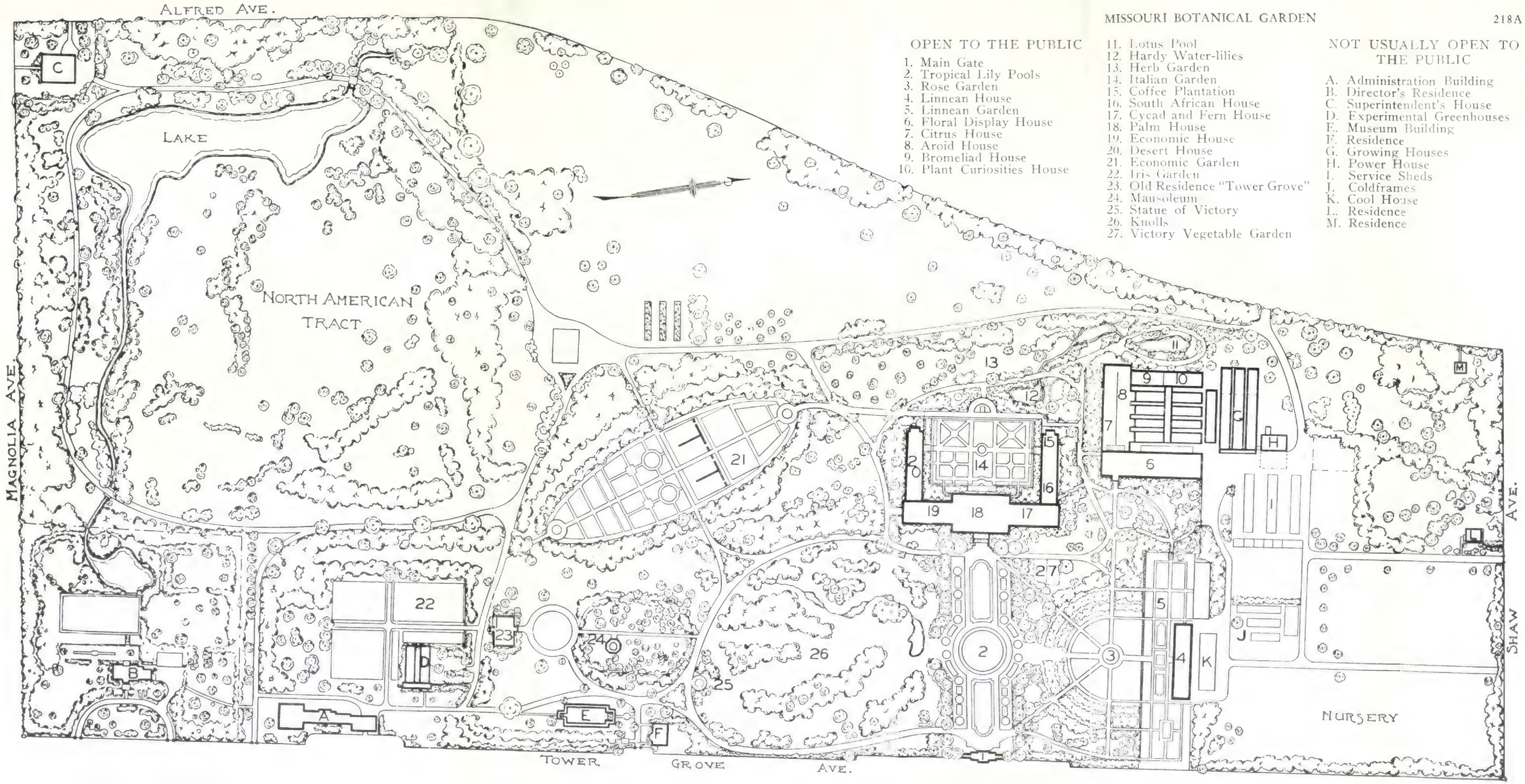
Immediately before us is the shady grove surrounding Mr. Shaw's **Mausoleum (24)**. Here, at his request, he was buried, in a tomb executed a few years before his death by Ferdinand Miller of Munich. In the mausoleum grounds is a collection

of oaks, under which has recently been developed an interesting series of ground covers. There are several strains of ivy, including the hardier "baltic ivy," snake grass, day-lilies, gill-run-over-the-ground, and periwinkle.

From the further end of the Mausoleum grounds there is a long vista through the Garden to the Linnean House in the distance. In the immediate foreground are the **Knolls** (**26**), an informal arrangement of shrubs and perennials. We may return to the Main Gate either by following the grassy paths through the Knolls or by a curving gravel walk at the right. This soon brings us to a large specimen of *Ginkgo biloba* (maidenhair tree), a species introduced into this country from the Orient where it has long been the object of veneration and is a frequent sight in the grounds around old temples. It is a remnant of a whole group of plants which flourished some millions of years ago but which have perished along with the giant animals of the same period. Even in China it has been exterminated as a forest tree and would have suffered the fate of its fellows had it not been for the Buddhist monks. Strangely enough, it takes kindly to modern city life and its fantastic branches and delicately shaped leaves are an ornament to the Garden as well as an object of scientific study. So long ago did this type of tree flourish in the world's forests and so completely have all the other members of its family been exterminated that one may well join Charles Darwin in calling it a "living fossil."

Just beyond the ginkgos are a group of Ozark Witch-Hazels *(Hamamelis vernalis)* which bloom on sunny days from January to March. A little farther on at the left is the strongly ribbed, red-brown trunk of an old Osage orange, a species often grown as a hedge plant but seldom allowed to develop into a tree. It is the "Bo-dark" (Bois d'arc) of the early settlers, a tree whose wood was used by the Indians in making bows.

We have now made a circuit of the principal features of the Garden, and the Main Gate comes again into view. There are many things we have rushed by and many interesting points which there has not been time to mention. We should like to tell you about the double-flowered redbud, to show you the **Victory Vegetable Garden** (**27**) near the Palm House, to point out the pygmy water-lilies, to take you around the North American tract, and to tell you more about the Arboretum at Gray Summit, on U. S. Highway 66.



OPEN TO THE PUBLIC

1. Main Gate
2. Tropical Lily Pools
3. Rose Garden
4. Linnean House
5. Linnean Garden
6. Floral Display House
7. Citrus House
8. Aroid House
9. Bromeliad House
10. Plant Curiosities House
11. Lotus Pool
12. Hardy Water-lilies
13. Herb Garden
14. Italian Garden
15. Coffee Plantation
16. South African House
17. Cycad and Fern House
18. Palm House
19. Economic House
20. Desert House
21. Economic Garden
22. Iris Garden
23. Old Residence "Tower Grove"
24. Mausoleum
25. Statue of Victory
26. Knolls
27. Victory Vegetable Garden

NOT USUALLY OPEN TO THE PUBLIC

A. Administration Building
B. Director's Residence
C. Superintendent's House
D. Experimental Greenhouses
E. Museum Building
F. Residence
G. Growing Houses
H. Power House
I. Service Sheds
J. Coldframes
K. Cool House
L. Residence
M. Residence

OF

WINTER COURSE IN GARDENING FOR AMATEURS

A course in gardening for amateurs, calculated to give the students as much practical work as possible, will start in February, 1943. The classes will be held in the experimental greenhouses, Tuesdays, 10:00 to 12:00 a. m. The course will be in charge of Dr. Fairburn.

REGISTRATION: It is desirable that registration be made by letter, with check enclosed payable to the Missouri Botanical Garden, as soon after January 1 as possible. Tickets will be distributed at the experimental greenhouses on day of first lecture.

FEE: The registration fee is $15.00 per student, and tickets are not transferable.

OUTLINE OF GARDENING COURSE

February 2—

The selection and care of house plants. Special exhibit of dependable plants for home use. Methods of forcing bulbs into flower during winter.

February 9—

The relation of soil to plant growth. Preparation of fertile garden soil and methods of testing fertility.

February 16—

How to improve soils by the use of fertilizers.

February 23—

Vegetable gardening. The planning, planting and general care of the family vegetable garden.

March 2 to March 30—

Plant propagation. Five class periods will be devoted to this important phase of gardening in order that the students may become familiar with a wide variety of plants and practice raising them from seeds and cuttings.

April 6—

Students will pot up plants raised from seed.

April 13—

Students will pot up plants raised from cuttings.

April 20—

Identification and control of common garden insects and diseases.

April 27—

Landscaping the home grounds. Preparation and care of lawns.

May 4—

Garden work demonstrated:

Pruning trees and shrubs.
Transplanting trees, shrubs, perennials.
Digging and preparing flower beds.
Application of lime and fertilizers.
Planting annuals and perennials.
Cultivating.
Spraying.

NOTES

Part of the article "Plants to Meet the War Emergency," from the June Garden BULLETIN, is reprinted in the October number of *Madison Cooper's Gardening Magazine* (6:191), under the title "Rubber from Native Plants."

The October number of *Madrono* (6:259-260) contains an article by Mr. Ralph O. Erickson, graduate student at the Garden, entitled "The Type of *Clematis hirsutissimus*."

Mr. Ladislaus Cutak, in charge of Succulents at the Garden, gave an illustrated lecture "Plant Hunting in Mexico," before the Business and Professional Women's group of the Y. W. C. A., December 1; and the same lecture before the South End Council No. 791, Royal Arcanum, December 4.

Dr. Edgar Anderson, Geneticist to the Garden, spoke before the Webster Groves Nature Study Society, November 20, on "Experiments with Indian Corn"; before the Garden Club of Louisiana, Mo., November 23, on "Indian Corn and the American Way of Life"; and before the St. Louis Wild Flower Club, December 2, on "Plant Identification."

Dr. David C. Fairburn, Horticulturist to the Garden, gave an illustrated talk, "The Romance of the Hybrid Orchid," at the annual convention of Iowa Florists at Iowa State College, Ames, on November 12. On that evening he repeated the talk at the annual meeting of the Federated Garden Clubs of Iowa at Iowa State College.

Recent visitors to the Garden include: Dr. H. K. Hayes, Agronomist and Plant Geneticist, Dr. H. K. Wilson, Agronomist, and Dr. A. C. Arny, Associate Agronomist, all of the Agricultural Experiment Station, University of Minnesota, St. Paul; Dr. Frederick D. Richey, formerly Chief Bureau of Plant Industry, U. S. Department of Agriculture, Washington, D. C.; Mr. Raymond Baker, Manager of the Breeding Department, Pioneer High-bred Corn Breeding Co., Johnston, Iowa; Dr. Neil E. Stevens, Head Department of Botany, University of Illinois, Urbana; and the following former graduate students at the Garden: Dr. Mildred Mathias (Mrs. Gerald Hassler), of Binghamton, N. Y., Pvt. Ralph Emons, of the Medical Corps, Camp Shelby, Miss., Pvt. (Dr.) Alexander F. Bucholtz, of the Medical Corps, Jefferson Barracks, Mo., and Rev. Robert R. Brinker, O.F.M., Instructor in Biology, Quincy College, Quincy, Ill.

STATISTICAL INFORMATION FOR NOVEMBER, 1942

GARDEN ATTENDANCE:

Total number of visitors 24,065

PLANT ACCESSIONS:

Total number of plants, seed packets, and bulbs received as gifts 604

LIBRARY ACCESSIONS:

Total number of books bought 9
Total number of books and pamphlets donated 114

HERBARIUM ACCESSIONS:

By Purchase—

University of California, by T. H. Goodspeed—Plants of South America 248

By Gift—

Allen, Paul H.—Plants of Panama 22
Baxter, R. W.—Plants of Hawaii 45
Anderson, E.—Plants of Missouri and Horticulture 7
Braun, E. Lucy—*Senecio obovatus* Muhl. var. *rotundus* Britton, from Kentucky 2
Degener, Otto—Plants of Hawaii, etc. 132
Demaree, Delzie—Plants of Arkansas 8
Field Museum of Natural History—Plant of Guatemala 1
Flory, Walter S.—*Quercus virginiana* x *Q. lyrata*, "The Ness Hybrid Oak" 7
Hubricht, Leslie—Plants of Missouri 53
Meyer, Fred G.—Cones of *Araucaria imbricata* Pav. 1
Sperry, Omer E.—*Tradescantia Wrightii* Rose & Bush, from Texas 1

By Exchange—

California Academy of Sciences—Plants of California 189
Clokey, Ira W.—Plants of Nevada 89
University of Kentucky, by Frank T. McFarland—Plants of Kentucky 100
University of Tucuman—Plants of Argentina 3
University of Wisconsin—Plants of Wisconsin, etc. 143

By Field Work—

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